

Five Things Good for Rheumatism.

To the Editor of The Globe:

Here are five prescriptions which have proved efficacious in rheumatism:

Soda salicyl. 1½ drachms.

Orange syrup, 3 ounces.

Pure water, 2 ounces.

Dose, teaspoonful every four hours.

Soda salicyl. 1 drachm.

Aqua plenal. 1 drachm.

Glycerine, 1 drachm.

• Elixir colocua. 1 drachm.

Dose, teaspoonful every four hours.

One gill alcohol.

One best's gall.

One gill spirits of turpentine.

One gill sweet oil.

Four ounces camphor gum.

Put in bottle and shake well. Use two or three times a day.

Dose, teaspoonful. Rub some on the afflicted parts before the fire.

Sweet oil, 2 ounces.

Cajepot, 1 ounce.

This makes a good rheumatic oil.

Acid salicylic, 2 drachms.

Soda bicarb. 3 drachms.

Syrup of lemon, 1 ounce.

Water sufficient for 4 ounces.

Dose, teaspoonful in water every three hours.

A good thing for the patient is to eat celery, cut into bits, boiled in water until soft, and the water drunk by the patient. The root and stalk can be boiled together.

Danvers.

C. A. W.

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THE
ARTIZANS' GUIDE

AND
EVERYBODY'S ASSISTANT:

CONTAINING OVER

THREE THOUSAND NEW AND VALUABLE

RECEIPTS AND TABLES

IN ALMOST EVERY BRANCH OF BUSINESS CONNECTED WITH CIVILIZED
LIFE, FROM THE HOUSEHOLD TO THE MANUFACTORY.

By R. MOORE.

PRICE IN CLOTH BINDING, \$2.

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1874.



PREFACE

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THE following work will be found to embrace an immense amount of the most valuable information regarding almost every branch of useful industry. The information has been collected from many sources with much care and expense, many of the items being valuable trade secrets, consequently obtainable only at a heavy cost. On the whole, "THE ARTIZAN'S GUIDE" will be found to embrace a vast amount of most useful knowledge in connection with business and manufacturing requirements, as well as the no less indispensable department of domestic uses, much of this information being very difficult to obtain in books. The Appendix, embracing the subject of correspondences, &c., is now inserted for the first time, and if favourably received will be inserted in future editions. Many persons who are in proper states for receiving these truths remain in total ignorance of their existence, and have no means of knowing them except through some such effort as this. These explanations are now appended for the benefit of all such, certainly not for my own personal emolument, except so far as happiness may be derived from the consciousness of having tried to benefit others, and this, beyond all doubt, is an exceeding great reward.

March 1873.

[Entered according to Act of Parliament, in the year One Thousand Eight Hundred and Seventy-two, by R. MOORE, in the office of the Minister of Agriculture and Statistics of the Dominion of Canada.]

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VALUABLE RECEIPTS.

BAKING AND COOKING DEPARTMENT.

BAKING BREAD.—The quantities and best manner of mixing the different ingredients necessary to make good bread, viz., to make the fermentation, say, for 10 buckets of flour; take 5 gals. of potatoes well boiled and mashed in a tub, with 1 bucket of water (in summer this water should be about milk-warm, in winter much warmer; in all cases this must be governed by the weather), six pounds of flour and five quarts of yeast; stir the whole up well, and cover till it rises. It is better to work the same as soon as it does rise and commences falling again; otherwise the bread will not be so good. The time of rising, however, varies much; sometimes it will rise in eight hours, at other times it will take much longer. Again, to make the sponge; take 2½ buckets of the above ferment, and 2½ buckets of water, milk-warm, run the whole through a sieve into a trough, and make it into light dough, with flour for sponge. When this sponge has risen and commenced falling, add 5 lbs. salt and 5 buckets of water; break the sponge well in the water, and stir up sufficient flour to make a stiff dough, cover it up until it rises sufficiently; it is then fit for being weighed off and put into the tins for baking. Let it stand in the tins until it rises, when it should be placed in the oven.

N.B.—A ½ oz. carbonate of magnesia added to the flour, for a 4 lb. loaf, materially improves the quality of the bread even when made from the very worst new seconds flour. It is usual with bakers to add alum to the flour, in order to make a white, light, and porous bread. Two ounces of alum per 100 lbs. flour is generally sufficient.

HOP YEAST.—Boil 5 gals. water and 10 ozs. hops together from 10 to 15 minutes; put 6 lbs. flour in a tub, to which add as much of the boiling liquor as will be necessary to make a thick paste. When the remainder of the liquor is perfectly cool, add it, together with 1 gal. of stock yeast, to the paste, when the whole will be ready for use.

MALT YEAST.—Boil 10 ozs. hops in 5 gals. of water from 10 to 15 minutes, pour the same into a tub. When cooled to 100° Fahr add ½ peck of malt; stir the whole up well, and cover it till nearly cool then add 3 qts. of old yeast to make it ferment.

ANOTHER EXCELLENT BREAD.—Knead 21 lbs. flour with 9 lbs. of pared and mashed potatoes, from which the water has been well steamed off previous to mashing; mix together while the potatoes are warm, adding about 3 or 4 spoonfuls of salt. Then add about 3 qts. milk-warm water, with 9 large spoonfuls of yeast, gradually to the potatoes and flour; knead and work it

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well into a smooth dough, and let it stand 4 hours before putting into the oven.

HEALTHY MIXED BREAD.—Boil 3 lbs. of rice to a soft pulp in water; pare and cook by steam 6 lbs. of your best potatoes, mash your potatoes, and rub them up with rice pulp; add to the whole 6 lbs. flour; make all into a dough with water, ferment with yeast, let it stand a proper length of time, and then place it in the oven to bake.

AERATED BREAD, WITHOUT YEAST.—1. Dissolve 1 oz. of sesquicarbonate of ammonia in water, sufficient to make 7 lbs. of flour into a dough, which must be formed into loaves, and baked immediately. 2. Divide 3 lbs. flour into two portions: mix up the first with water, holding in solution 2 oz. bicarbonate of soda; then mix the second portion of flour with water, to which 1 oz. of muriatic acid has been added; knead each mass of the dough thoroughly. When this is done, mix both portions together as rapidly and perfectly as possible, form the mass into loaves, and bake immediately. This bread contains no yeast, and is very wholesome.

NOTE.—Bicarbonate of soda and muriatic acid, when chemically combined, form common salt.

SUPERIOR BREAD FROM BUCKWHEAT MEAL.—To 2 qts. of sifted buckwheat meal, add hot water enough to wet the same; when sufficiently cooled, add 1 teaspoonful or more of salt, half a pint of yeast, and half a teaspoonful of molasses; then add wheat flour enough to make it into loaves (it should be kneaded well); and when risen light, bake or steam it three or more hours. If this should get sour while rising, add a teaspoonful of sugar and a little saleratus, dissolved in water. For bread from Indian meal proceed in the same way, using it instead of the buckwheat meal.

CORN-MEAL BREAD No. 1.—Take 2 qts. of corn meal, with about a pint of (thin) bread sponge, and water enough to wet it; mix in about half a pint of wheat flour, and a tablespoonful of salt; let it rise, and then knead well the second time; bake 1½ hours.

CORN-MEAL BREAD No. 2.—Mix 2 qts. of new corn meal with three pints of warm water; add 1 tablespoonful of salt, 2 tablespoonfuls of sugar, and 1 large tablespoonful of hop yeast; let it stand in a warm place five hours to rise; then add 1½ teacupfuls of wheat flour, and half a pint of warm water. Let it rise again 1½ hours, then pour it into a pan well greased with sweet lard, and let it rise a few minutes. Then bake, in a moderately hot oven, 1 hour and 30 minutes.

CORN-MEAL BREAD No. 3.—Take 2 qts. of white corn-meal, 1 tablespoonful of lard, 1 pint of hot water; mix the lard in water; stir it well that it may get heated thoroughly, and add one-half pint of cold water. When the mixture is cool enough, add two well-beaten eggs, and two tablespoonfuls of home-made yeast. Bake 1 hour in a moderately heated oven. If for breakfast, make over night.

LONDON BAKERS' BREAD.—To make a half-peck loaf, take ¾ lbs. of well-boiled, mealy potatoes; mash them through a fine colander or coarse sieve; add ¼ pt. of yeast, or ¼ oz. German dried yeast,

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and $\frac{1}{2}$ pt. lukewarm water (88° Fahr.), together with $\frac{1}{2}$ lb. of flour, to render the mixture the consistence of thin batter; this mixture is to be set aside to ferment; if set in a warm place, it will rise in less than two hours, when it resembles yeast except in color. The sponge so made is then to be mixed with 1 pt. of water nearly blood warm, viz., 92° Fahr., and poured into a half peck of flour, which has previously had $\frac{1}{2}$ oz. salt mixed into it; the whole should then be kneaded into dough, and allowed to rise in a warm place for 2 hours, when it should be kneaded into loaves, and baked.

FRENCH BREAD.—Take nice rice, $\frac{1}{2}$ lb.; tie it up in a thick linen bag, giving enough room for it to swell; boil from three to four hours till it becomes a perfect paste; mix while warm with 7 lbs. flour; adding the usual quantities of yeast, salt, and water. Allow the dough to work a proper time near the fire, then divide into loaves, dust them in, and knead vigorously. This quantity will make 13 lbs. 7 oz. of very nutritious bread.

PARIS BAKER'S WHITE BREAD.—On 80 lbs. of the dough left from the previous day's baking, as much luke-warm water is poured as will make 320 lbs. flour into a rather thin dough. As soon as this has risen, 30 lbs. are taken out, and reserved in a warm place for next day's baking. One pound of *dry yeast* dissolved in *warm water* is then added to the remaining portion, and the whole lightly kneaded. As soon as it is sufficiently "risen," it is then made into loaves, and shortly afterwards baked, the loaves being placed in the oven without touching each other, so that they may be "crusted" all round.

BROWN BREAD.—Take equal quantities of Indian meal and rye flour, scald the meal, and when lukewarm add the flour, adding one-half pint of good yeast to four quarts of the mixture, a tablespoon, even full, of salt, and half a cup of molasses, kneading the mixture well. This kind of bread should be softer than wheat flour bread. All the water added after scalding the meal should be lukewarm. When it has risen well, put it to bake in a brick oven or stove, the former should be hotter than for flour bread; if a stove oven, it should be steamed two hours then baked one hour or more; when done it is a dark brown. The best article for baking this kind of bread is brown earthenware—say pans eight or ten inches in height, and diameter about the same; grease or butter the pans; put in the mixture; then dip your hand in cold water and smooth the loaf; after this slash the loaf both ways with a knife, quite deep. Some let it rise a little before they put it to bake. Many people prefer this bread made of one-third rye flour instead of one half. When it is difficult to get rye, wheat flour will answer as a substitute. It adds very much to the richness and flavor of this kind of bread to let it remain in the oven over night.

GINGERBREAD.—Mix together $3\frac{1}{2}$ lbs. of flour; $\frac{1}{2}$ lb. butter; 1 lb. sugar; 1 pint molasses; $\frac{1}{4}$ lb. ginger, and some ground orange-peel.

DYSPEPSIA BREAD.—The following receipt for making bread has proved highly salutary to persons afflicted with dyspepsia, viz:— $\frac{1}{2}$ quarts unbolted wheat meal; 1 quart soft water, warm but not

hot ; 1 gill of fresh yeast ; 1 gill molasses, or not, as may suit the taste ; 1 teaspoonful of saleratus.

RULES TO BE OBSERVED IN CAKE-MAKING.—1. In making cakes, use refined white sugar, although clean brown sugar does as well. 2. Use good sweet butter in every case. 3. Cake mixture cannot be beaten too much. 4. An earthen basin is the best for beating cake mixture, or eggs in. 5. A good regular heat must be kept up in the oven. 6. Use a broom splint to run through the thickest part of the cake ; if done, it will come out clean, if not done, there will be some of the dough sticking to it. This rule applies to bread also. The following cakes will be found to come out all right with a fair trial.

SUPERIOR INDIAN CAKE.—Take 2 cups of Indian meal, 1 table-spoonful of molasses, 2 cups milk, a little salt, a handful of flour, and a little saleratus ; mix thin, and pour it into a buttered bake-pan, and bake half an hour.

NUT CAKES.—Take 1 lb. flour, $\frac{1}{4}$ lb. butter, same of sugar, five eggs, and spice to your taste.

SEED CAKE.—1 tea-cup butter, 2 cups sugar, rubbed into 4 cups flour ; mix with milk hard enough to roll : $\frac{1}{4}$ teaspoonful saleratus ; seeds to your taste.

BUCKWHEAT CAKE.—Make a batter of buckwheat flour as you would for pan-cakes ; let it rise light. Then to each quart of the batter add 1 cup of molasses, 2 eggs, 1 teaspoonful of saleratus, a few caraway seeds, and 1 teacupful wheat flour ; stir well together, pour into a greased breadpan, and bake in a moderate hot oven $\frac{1}{4}$ of an hour.

ALMOND CAKE.—Take one pound of almonds, blanched and beaten ; ten eggs, well beaten ; three-quarters of a pound of sugar, and three-quarters of a pound of flour, well mixed and baked.

WEDDING CAKE.—Take three lbs. flour, three lbs. butter, three lbs. sugar, two dozen eggs, four lbs. raisins, six lbs. of currants, two lbs. citron, one ounce mace, one ounce cinnamon, one ounce nutmeg, half-ounce cloves, half-pint brandy. Beat the batter with your hand to cream ; then beat the sugar into the butter ; add the froth of the yolks of the eggs, after being well beaten, then the froth of the whites, mix fruit, spice and flour together, then add them in, baking five or six hours for a large loaf.

POUND CAKE.—One pound of flour, one pound of sugar, one pound of butter, eight eggs, three spoonfuls rose-water, mace, or other spice.

BUCKWHEAT SHORT CAKE.—Take 3 or 4 cups nice sour milk, 1 teaspoonful of soda saleratus dissolved in the milk ; if the milk is very sour, you must use saleratus in proportion with a little salt ; mix up a dough with buckwheat flour thicker than you would mix the same for griddle cakes, say quite stiff ; put into a buttered tin, and put directly into the stove oven, and bake about 30 minutes, or as you would a short-cake from common flour.

SHORT CAKE.—5 lbs. flour, 8 oz. butter, $\frac{1}{4}$ lbs. sugar, 8 eggs, rose-water and nutmeg.

SUGAR CAKE.—Take 7 eggs, and beat the whites and yolks separately : then beat well together ; now put into them sifted white sugar, 1 lb. ; with melted butter, $\frac{1}{2}$ lb. ; add a small teaspoonful of

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pulverized carbonate of ammonia. Stir in just sufficient sifted flour to allow of its being rolled out, and cut into cakes.

GINGER CAKE.—Flour 3 lbs., sugar and butter, each 1 lb., ginger 2 oz., molasses 1 pint, cream $\frac{1}{4}$ pt. and a little nutmeg; mix warm and bake in slack oven.

PLUM CAKE.—Flour 1 lb., butter $\frac{1}{4}$ lb., sugar $\frac{1}{4}$ lb., currants $\frac{1}{4}$ lb., 3 eggs, $\frac{1}{2}$ pint milk, carbonate of soda, a small teaspoonful.

RICH SODA CAKE.—1 pound of pulverized loaf-sugar mixed with $\frac{1}{2}$ lb. of sweet butter, the beaten whites of 14 eggs, and two teaspoonfuls of cream of tartar, sifted with a pound of flour, and lastly, a teaspoonful of soda dissolved in half a teacupful of sweet milk, and strained. Bake immediately.

DELICATE TEA CAKE. The whites of 3 eggs beaten to a froth, 1 cup of pulverized white sugar, $\frac{1}{2}$ cup of sweet milk, one teaspoonful of cream of tartar, $\frac{1}{4}$ teaspoonful of soda, $2\frac{1}{2}$ cups of flour, a teaspoonful of almonds, $\frac{1}{2}$ cup of melted butter.

STRAWBERRY SHORT CAKE.—One teacupful of sour milk (not buttermilk), a piece of butter the size of a walnut, $\frac{1}{4}$ teaspoonful of soda, $\frac{1}{4}$ teaspoonful of salt. Mix very lightly, and bake in a quick oven. While baking, take $1\frac{1}{2}$ pts. of strawberries, mashed fine with the hand; when the cake is cooked enough, cut in two, taking off about $\frac{1}{3}$, leaving $\frac{2}{3}$ at the bottom; spread each part thickly with batter, then put on the large portion a layer of sugar, then the berries, then sugar, and lastly, turn the other part over. Serve immediately.

SPONGE CAKE.—Sift 1 lb. of flour and 1 lb. of loaf sugar; take the juice of 1 lemon, beat 10 eggs very light, mix them well with the sugar, then add the lemon and flour; if baked in a pan, two hours is necessary.

LOAF CAKE.—Take 2 lbs. of flour, $\frac{1}{4}$ lb. of sugar, $\frac{1}{4}$ lb. of butter, 3 eggs, 1 gill of milk, $\frac{1}{4}$ teacupful of sweet yeast, cloves and nutmeg for spice.

CREAM CAKE.—1 teacup cream, 2 teacups sugar, three well beaten eggs, teaspoonful saleratus dissolved in a wine glass of milk, piece of butter half the size of an egg, flour to make as thick as pound cake, add raisins and spice to taste; wine and brandy if you like.

CORN STARCH CAKE.— $\frac{1}{2}$ lb. of sugar, 4 oz. of butter, 5 eggs, 1 teaspoonful cream of tartar, $\frac{1}{2}$ teaspoonful soda, $\frac{1}{2}$ pound of corn starch, $\frac{1}{2}$ a gill of sweet milk.

RAILROAD CAKE.—A pint of flour 1 teaspoonful of cream of tartar, $\frac{1}{4}$ a teaspoonful of soda, a tablespoonful of butter, a teaspoonful of sugar; bake the batter in a square pan twenty minutes.

MOUNTAIN CAKE.—1 cup of sugar, 2 eggs, half cup butter, half cup of milk or water, 2 cups of flour, teaspoonful of cream of tartar, half a teaspoonful of soda, nutmeg.

POOR MAN'S CAKE.—1 cup of sugar, $\frac{1}{2}$ cup of butter, 1 cup sour cream, 1 egg, flour enough to make a good batter, $\frac{1}{2}$ a teaspoonful of saleratus.

FRUIT CAKE.— $1\frac{1}{2}$ lbs. sugar, $1\frac{1}{2}$ lbs. flour, $\frac{3}{4}$ lb. butter, 6 eggs, a pint of sweet milk, 2 teaspoonfuls saleratus, 1 glass of wine, 1 of brandy, and as much fruit and spice as you can afford and no more.

SCOTCH SHORT BREAD.—Flour 2 pounds, butter 1 pound, brown sugar $\frac{1}{2}$ pound, blanched almonds, cut small, $\frac{1}{4}$ pound, candied lemon peel, $\frac{1}{4}$ pound; beat the butter to a cream, and add it to the flour and sugar with the other ingredients. When well kneaded and incorporated roll it out into cakes about one inch thick. Bake in a moderate oven.

GOLD CAKE.—Yolks of 1 doz. eggs; flour, 5 cups; white sugar, and butter, of each, one cup; cream or sweet milk, 1 cup; cream of tartar, 1 teaspoon; soda, $\frac{1}{2}$ teaspoon. Beat the eggs with the sugar; have the butter softened by the fire, then stir it in; put the soda and cream of tartar into the cream or milk, stirring up and mixing all together; then sift and stir in the flour.

WONDERS.—2 pounds flour, $\frac{1}{2}$ pound butter, $\frac{1}{2}$ ounce sugar, 10 eggs, cinnamon.

COOKIES.—3 pounds flour, $\frac{1}{2}$ pound butter, $\frac{1}{2}$ pound sugar, 3 eggs; or, without eggs, wet up, raise with saleratus and sour milk.

COMMON.—12 pounds flour, 3 pounds butter, 3 pounds sugar, 2 quarts milk, yeast, spice to taste.

LOAF.—9 quarts flour, 3 pounds butter, 4 pounds sugar, 1 gallon milk, wine 1 pint, yeast 1 pint.

CIDER CAKE.—Flour, 6 cups; sugar, 3 cups; butter, 1 cup; cider, 1 cup; saleratus, 1 teaspoon; 4 eggs; 1 grated nutmeg. Beat the eggs, sugar, and butter together, and stir in the flour and nutmeg; dissolve the saleratus in the cider, and stir into the mass, and bake immediately in a quick oven.

MOLASSES CAKE.—Molasses, $\frac{1}{2}$ cups; saleratus, 1 teaspoon; sour milk, 2 cups; 2 eggs; butter, lard, or pork gravy, what you would take upon a spoon; if you use lard, add a little salt. Mix all by beating a minute or two with a spoon; dissolving the saleratus in the milk; then stir in flour to give it the consistency of soft cake and put directly into a hot oven, being careful not to dry by over baking.

ROCK CAKES.—Mix together 1 lb. of flour; $\frac{1}{2}$ lb. of sugar; $\frac{1}{2}$ lb. of butter; $\frac{1}{2}$ lb. of currants or cherries, and 4 eggs, leaving out the whites of 2; a little wine and candied lemon-peel are a great improvement.

JUMBLES.—Take 1 lb. of loaf-sugar, pounded fine; $1\frac{1}{2}$ lb. of flour; $\frac{1}{2}$ lb. of butter; 4 eggs, beaten light, and a little rose-water and spice; mix them well, and roll them in sugar.

CUP CAKES.—Mix together 5 cups of flour; 3 cups of sugar; 1 cup of butter; 1 cup of milk; 3 eggs well beaten; 1 wine-glass of wine; 1 of brandy, and a little cinnamon.

CYMBALS.—2 lbs. flour, 8 oz. butter, $\frac{1}{2}$ lb. sugar, 6 eggs, rose-water and a little spice.

FROSTING, OR ICING, FOR CAKES.—The whites of 8 eggs, beat to a perfect froth and stiff; pulverized white sugar, 2 lbs.; starch, 1 tablespoon; pulverized gum arabic, $\frac{1}{2}$ oz.; juice of 1 lemon; sift the starch, sugar and gum arabic into the beaten egg, and stir all thoroughly, when the cake is cold lay on the frosting to suit.

JUMBLES.—Butter 1 lb., sugar 1 lb., flour 2 lbs., 3 eggs, $\frac{1}{2}$ cup of sour milk; 1 teaspoonful of soda, roll in white coffee sugar. This will make a large batch.

DOUGHNUTS.—Sugar and milk, 2 cups of each; saleratus, 1 tea-

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spoonful; 3 eggs, and a piece of butter half as large as a small hen's egg, and flour sufficient.

CRULLERS.—Sugar and melted butter, 6 tablespoonfuls of each; 6 eggs, and flour to roll.

BUNS.—1 cup butter, 1 cup sugar, $\frac{1}{2}$ cup of yeast, $\frac{1}{2}$ pint of milk; make it stiff with flour; add, if you like, nutmeg.

COCOANUT DROPS.—1 lb. grated cocoanut, $\frac{1}{2}$ lb. white sugar, the white of 6 eggs, cut to a stiff froth. You must have enough whites of egg to wet the whole mixture. Drop on buttered plates, in pieces the size of an egg.

FRENCH ROLLS.—1 ounce of butter, 1 lb. of flour, 1 gill of home-made yeast, 1 egg, milk enough to make a dough. Rub the butter through the flour, beat the egg and stir in, then add the yeast, milk, and a little salt. Knead the dough; when it is light, mould it out into large biscuits, and bake them on tins.

MUFFINS.—A quart of milk, 2 eggs, 2 spoonfuls of yeast, 2 lbs. of flour, a lump of butter size of an egg—which is to be melted in the milk—and a little salt; the milk is to be warmed, and the ingredients added. Let it rise, and then turn the mixture into buttered pans, and bake to a light brown.

BATH CAKES.—Mix well together, 1 lb. flour, $\frac{1}{2}$ lb. butter, 5 eggs, and a cupful of yeast, set the whole before the fire to rise; after it rises, add $\frac{1}{2}$ lb. white sugar, and 1 ounce carraway seeds well mixed in, and roll the paste into little cakes, bake them on tins.

No. 1 CRACKERS.—Butter, 1 cup; salt, 1 teaspoon; flour, 2 qts. Rub thoroughly together with the hand, and wet up with water; beat well, and beat in flour to make quite brittle and hard; then pinch off pieces, and roll out each cracker by itself.

SUGAR CRACKERS.—Flour, 4 lbs.; loaf sugar and butter, of each $\frac{1}{2}$ lb.; water, $\frac{1}{2}$ pts.; make as above.

NAPLES BISCUIT.—White sugar, eggs, and flour, of each 4 lbs.

LEMON BISCUIT.—Take 3 $\frac{1}{2}$ lbs. white sugar, 4 lbs. flour, $\frac{1}{2}$ ounce saleratus, $\frac{1}{2}$ lb. suet, a little milk to wet the dough, cut them out about the size of marbles, put them on pans a little greased, and bake them in a hot oven and flavor them with essence of lemon.

ABERNETHY BISCUIT.—Take 8 lbs. of flour, 1 $\frac{1}{2}$ lb. of butter, 1 quart of sweet milk, 12 ounces of sugar, 1 ounce of carraway seed, 6 eggs; mix dough of the above, break them in pieces of about two ounces, mould them off, roll them out, prick them and bake them in a moderate oven.

SAVOY BISCUIT.—Take of sugar the weight of 14 eggs, of flour the weight of 6 eggs, beat the yellows and whites of 12 eggs, separate, grate in the rind of a lemon; after being in the oven a few minutes grate on some sugar. You may add peach-water, or lemon-juice, or any flavoring extract.

GINGER SNAPS.—Take 7 lbs. of flour, 1 quart of molasses, 1 lb. of brown sugar, 1 lb. butter, 2 ounces of ground ginger, and then take 1 gill of water, $\frac{3}{4}$ of an ounce of saleratus; mix them all into dough, and cut them out something larger than marbles, and bake them in a moderate oven.

YORK BISCUIT.—3 lbs. flour, $\frac{1}{2}$ lb. butter, $\frac{1}{2}$ lbs. sugar: wet up, and raise with sour milk and saleratus.

TRAVELLER'S BISCUIT.—2 lbs. of flour, $\frac{3}{4}$ of a pound of sugar, $\frac{1}{4}$ lb. butter, 1 teaspoonful of dissolved saleratus, milk sufficient to form a dough. Cut up the butter in the flour, add the sugar, and put in the saleratus and milk together, so as to form dough. Knead it till it becomes perfectly smooth and light. Roll it in sheets about $\frac{1}{2}$ of an inch thick, cut the cakes with a cutter or the top of a tumbler. Bake in a moderate oven.

BAKING POWDER FOR BISCUIT.—Bicarbonate of soda 4 lbs., cream of tartar 8 lbs. These ingredients should be thoroughly dried and well mixed, and put up proof against dampness. Use about 3 teaspoonfuls to each quart of flour, mix up with cold water or milk, and put it into the oven at once.

BROWN BREAD FOR BISCUITS.—Corn meal 4 qts., rye flour 3 qts., wheat flour 1 qt., molasses 2 tablespoonfuls, yeast 6 tablespoonfuls, soda 2 teaspoonfuls. Mix during the evening for breakfast.

MINCE PIES.—Meat 1 lb., suet $3\frac{1}{2}$ lbs., currants, raisins and plums, 2 lbs., one glass brandy or wine; allspice, cinnamon and cloves to your taste, sugar sufficient to sweeten. Baked in a short crust.

FRUIT PIES.—For all kinds of fruit pies have your fruit sweetened to your taste, and then put in a short crust. Bake in a hot oven.

PUMPKIN PIE.—Stew the pumpkin dry, and make it like squash pie, only season rather higher. In the country, where this *real Yankee pie* is prepared in perfection, ginger is almost always used, with other spices. There, too, part cream, instead of milk, is mixed with the pumpkin, which gives a richer flavor.

LEMON PIE.—1 lemon grated, 2 eggs, $\frac{1}{2}$ cup of sugar, 1 cup of molasses, 1 of water, and 3 tablespoonfuls of flour. This makes 3 pies.

LEMON PIE WITH THREE CRUSTS.—A layer of crust, a layer of lemon, sliced fine, a little sugar, layer of crust again, and sugar and lemon again, then the upper crust.

Another Way.—1 cup of sugar, 1 cup of sweet milk, 1 egg, $1\frac{1}{2}$ lemon the grated peel and juice, 1 tablespoonful of flour; then after baking, the white of an egg beaten, sweetened, and put on the top; then set in the oven and browned.

CRUMB PIE.—Mince any cold meat very finely, season it to taste, and put it into a pie-dish; have some finely-grated bread crumbs, with a little salt, pepper, and nutmeg, and pour into the dish any nice gravy that may be at hand; then cover it over with a thick layer of the bread crumbs, and put small pieces of butter over the top. Place it in the oven till quite hot.

WASHINGTON PIE.—1 cup of sugar, third of a cup of butter, half a cup of sweet milk, 1 and a third cup of flour, 1 egg, half a teaspoonful of soda, 1 of cream of tartar, lemon flavor. Grease 2 round tins, and put in the above. Bake until done. Then put it on a dinner plate, spread with nice apple-sauce, or sauce of any kind; then another layer of cake on top. It is nice without sauce, but sauce improves it.

FRUIT PIE.—1 cup of sugar, 1 of water, tablespoonful of flour, teaspoonful of lemon essence (or lemon grated) 1 teaspoonful of cream of tartar, half a teaspoonful of soda, half a cup of dried currants; mix and boil, stirring to prevent the flour from settling.

CHICKEN PIE.—Take one pair of good young chickens, cut in small

pieces, season with pepper and salt and small strips of salt pork, put in saucepan with water to cover it, boil for half an hour, add flour and butter to thicken the gravy, have ready a large dish, served with paste, put all in the dish covered with a good rich paste. Bake for half an hour.

VEAL POT PIE.—Take 2 pounds of best veal, cut in small pieces, half pound of salt pork, sliced thin, four quarts of cold water; pepper and salt all, put on the fire; after boiling for 1 hour have 3 pounds of light bread dough, pick small pieces, say one ounce pieces, put in saucepan, with the veal and pork and let it boil for twenty minutes. Serve as soon as taken from the fire.

PLUM PUDDING.—Pound 6 crackers, and soak them over night in milk enough to cover them, then add 3 pints of milk, 4 or 5 eggs, raisins $\frac{1}{2}$ lb., spice with nutmeg and sweeten with sugar and molasses. Bake about 2 hours.

TAPIOCA PUDDING.—Pick and mash a coffee cup full of tapioca, and pour upon it 1 pint boiling milk; after standing $\frac{1}{2}$ an hour, add another pint of cold milk, with sugar and raisins if you desire.

BAKED PUDDING.—5 tablespoonfuls of corn starch to 1 quart of milk, dissolve the starch in a part of the milk, heat the remainder of the milk to nearly boiling, having salted it a little, then add the dissolved starch to the milk, boil 3 minutes, stirring it briskly; allow it to cool, and then thoroughly mix with it 3 eggs, well beaten, with 3 tablespoonfuls of sugar; flavor to your taste and bake it $\frac{1}{2}$ an hour. This pudding ranks second to none.

ORANGE PUDDING.—Take 1 lb. of butter, 1 lb. of sugar, 10 eggs, the juice of 2 oranges, boil the peel, then pound it fine and mix it with the juice. Add the juice of 1 lemon, a wineglassful of brandy, wine and rose-water. If you do not have the fruit add the extracts.

COCOANUT PUDDING.—To a large grated cocoanut add the whites of 6 eggs, $\frac{1}{2}$ lb. of sugar, 6 ounces of butter, $\frac{1}{2}$ a wineglassful of rose-water, and baked in or out of paste.

RICE PUDDING.—Take 1 lb. of rice, boiled well with rich milk, stirring well until it is soft, and then add $\frac{1}{2}$ lb. butter, 12 eggs, well beaten, and spice to your taste, and bake it.

HARD TIMES PUDDING.— $\frac{1}{2}$ pint of molasses or syrup, $\frac{1}{2}$ pint water, 2 teaspoonfuls of soda, 1 teaspoonful of salt, flour enough to make a batter; boil in a bag for 3 hours. Eat it with sauce.

BAKED APPLE PUDDING.—Pare and quarter four large apples, boil them tender with the rind of a lemon in so little water that when done no water may remain, beat them quite fine in a mortar, add the crumb of a small roll, $\frac{1}{2}$ lb. of butter melted, the yolks of 6 and whites of 3 eggs, juice of $\frac{1}{2}$ lemon, sugar to your taste, beat all well together, all in paste.

GROUND RICE, OR SAGO PUDDING.—Boil a large spoonful of it, heaped, in 1 pint milk with lemon peel and cinnamon; when cold add sugar, and nutmegs, and 4 eggs, well beaten.

CUSTARD PUDDING.—Take 1 pint milk, 4 spoonfuls flour, 6 eggs, spice to your taste and bake.

WINTER PUDDING.—Take the crust of baker's loaf of bread, and fill it with plums, boil it in milk and water.

BAKED POTATOE PUDDING.—Baked potatoes skimmed and mashed 12 oz., suet 1 oz., cheese, grated fine, 1 oz., milk 1 gill. Mix the potatoes, suet, milk, cheese and all together, if not of a proper consistence, add a little water. Bake in an earthen pot

COLLEGE PUDDINGS.— $\frac{3}{4}$ lb. of stale bread, grated; the same quantity of beef suet, chopped very fine; 1 lb. of currants, $\frac{1}{2}$ nutmeg, a few cloves, a glass of brandy, 2 or 3 eggs, 2 spoonfuls of cream or milk; mix these well together, and make into a paste in the shape of eggs. Fry them gently over a clear fire, in $\frac{1}{2}$ lb. of butter; let them be of a nice brown color all over. You may add blanched almonds and sweetmeats. Serve them up with wine

FAMILY PUDDING.—1 quart of sweet milk, 1 pint of bread crumbs soaked in the milk, 3 eggs well beaten, 1 teacupful of sugar, little mace, 6 good tart apples, pared, cores *dug* out, and stand them in the pudding, and steam until the apples are well done. An hour will suffice.

COTTAGE PUDDING.—1 egg, 1 cup of sugar, 1 of sweet milk, 1 teaspoonful of soda, 2 of cream of tartar, 1 pint of flour, and a little salt. To be beaten with milk and sugar

GREEN GOOSEBERRIES make a nice pudding by stirring a pint of them into a pint of batter, and either baking or boiling

LEMON PUDDING.—Melt 6 oz. of butter, pour it over the same quantity of powdered loaf sugar, stirring it well till cold, then grate the rind of a large lemon, and add it with 8 eggs well beaten and the juice of 2 lemons: stir the whole till it is completely mixed together, and bake the pudding with a paste round the dish.

SAUCES AND CREAMS FOR PUDDINGS.—1. Take equal quantities of sugar and molasses, boil them together, and stir in a little flour. 2. Take the juice of an orange, a cup of sugar and the same of good cream. 3. Good sour cream made very sweet with sugar, with or without seasoning, makes a good sauce. 4. Beat 2 eggs well, then add a cup of stewed apples and a cup of sugar.

BEEF STEAK WITH ONIONS.—Prepare a rump steak by pounding it till quite tender, season with salt, pepper and fresh butter, put in the steak and fry it, when brown on one side turn over, do not let it scorch, when nicely done, take it up, put a little flour over the steak, then add gradually a cup of hot water, seasoned with more salt and pepper, if necessary; then put the water over the fire and boil again, and pour over the steak

Peel 2 dozen onions, put them on to boil with about 2 quarts of water an hour before the steak is put on to fry. When the steak is done, cut them up, put them in the frying pan, season well with salt, pepper, and butter, sprinkle with flour, stir all well together, place over the fire, stir often to prevent scorching; when they are a little brown and soft, turn them over the steak

SEASONING FOR STUFFING.—1 lb. of salt, dried and sifted; half an ounce of ground white pepper; two ounces of dried thyme; 1 oz. of dried marjoram; and one oz. of nutmeg. When this seasoning is used, parsley only is required to be chopped in sufficient quantity to make the stuffing green. The proportions are— $\frac{1}{2}$ pound of bread crumbs; 3 eggs; $\frac{1}{4}$ lb. of suet; $\frac{1}{2}$ oz. of seasoning; and the peel of half a lemon, grated.

ECONOMICAL SOUP.—Put into a saucepan one-pound pieces of stale bread, three large onions sliced, a small cabbage cut fine, 4 carrots and turnip, and a small head of celery (or the remains of any cold vegetables), a tablespoonful of salt, a tablespoonful of pepper, a bunch of parsley, a sprig of marjoram and thyme. Put these into two quarts of any weak stock, (the liquor in which mutton has been boiled will do,) and let them boil for two hours; rub through a fine hair-sieve, add a pint of new milk, boil up, and serve at once.

VEGETABLE SOUP.—Take a shin of beef, 3 large carrots, 3 large yellow onions, 6 turnips, $\frac{1}{2}$ pound of rice or barley; parsley, leeks, summer savory; put all into a soup-kettle, and let it boil four hours; add pepper and salt to taste; serve altogether. It makes a good family soup.

PEA SOUP.—Beef 5 lbs., water 5 qts., 6 large carrots, 6 good turnips, 3 large onions, salt sufficient, put it on a good slow fire, let it boil 3 hours, then strain all the broth from meat and vegetables, and then add 3 lbs. of split peas to the broth; set it on a slow fire for 2 hours, stirring often, so that all the peas will dissolve; take 1 lb. fresh sausage meat, fried to a crisp and fried bread crumbs; put all together, add a few fine herbs, and serve hot.

FRICASSEE CHICKENS.—Take 2 large young chickens, cut in small pieces, put in cold water for 1 hour to take all the blood out, then put in saucepan to parboil for half an hour, then take from saucepan drained well, have ready 1 qt. good fresh cream, 2 oz. good butter, 1 oz. of flour, all well mixed together; put in saucepan with the chickens; put on the fire to boil tender; season with pepper and salt; served with toast bread in the bottom of the dish.

BAKED TOMATOES.—Wash the tomatoes, take out the seed, make a dressing of crumbs of bread and onions chopped fine; add salt, butter and pepper. Bake and serve hot.

STEWED TOMATOES.—Scald the tomatoes with hot water, take off the skins. put them in an earthen vessel, strain off the water and add butter, salt and pepper to taste.

MASHED TURNIPS.—Wash turnips. boil well, take them up in the colander, press out all the water, wash very fine; season with salt, butter and sugar. Serve hot with trimmings.

HASHED MEAT.—Take 2 lbs of fat corned beef, well boiled and cold; 1 lb. of well boiled potatoes, cold; 1 large white onion; put in chopping tray, mince it fine, put all in saucepan together, add 2 ozs. butter; pepper and salt to taste; add boiling water to make it soft; set it on a slow fire, stirring it often. When well stewed serve hot. It makes a fine relish for breakfast.

LOBSTER SALAD.—Take inside of large lobster, mince fine, take yolk of 2 eggs boiled hard and mashed fine, with four tablespoonfuls of sweet oil; pepper, salt, vinegar, and mustard to taste; mix well; add celery or lettuce to taste; then when serving, garnish with hard-boiled eggs.

SUCCOTASH.—Take 1 doz. ears of corn, cut the grains from the cob, add 1 qt. of Lima beans, and mix with the corn; put it on to boil in 3 qt. of water with 1 lb. of pork cut, add black pepper and

salt to taste. When the water has boiled away to $\frac{1}{3}$ the original quantity, serve in a tureen as soup.

MACCARONI SOUP.—4 lbs. of lean beef, 4 qts. of water, carrot, turnip, onions; set it for 4 hours till all mix together; strain it all through a sieve; have 2 lbs. of macaroni broken into pieces of one inch long; put all into a saucepan together, and let it boil for 10 minutes, and serve it hot.

BOILED CUSTARD, OR MOCK CREAM.—Take 2 tablespoonfuls of corn starch, 1 qt. of milk, 2 or 3 eggs, $\frac{1}{4}$ a teaspoonful of salt and a small piece of butter, heat the milk to nearly boiling and add the starch, previously dissolved in 1 qt. of milk, then add the eggs, well beaten, with 4 tablespoonfuls of powdered sugar; let it boil up once or twice, stirring it briskly, and it is done. Flavor with lemon or vanilla, or raspberry, or to suit your taste.

LEMON CREAM.—Take a pint of thick cream and put to it the yolks of two eggs, well beaten, $\frac{1}{2}$ oz. of fine sugar and the thin rind of a lemon, boil it up, then stir till almost cold, put the juice of a lemon in a dish or bowl and pour the cream upon it, stirring till quite cold.

FRUIT CREAMS.—Take $\frac{1}{4}$ oz. of isinglass dissolved in a little water, then put 1 pt. of good cream, sweetened to the taste; boil it. When nearly cold lay some apricot or raspberry jam on the bottom of a glass dish and pour it over. This is most excellent.

RASPBERRY CREAM.—Put 6 ozs. of raspberry jam to 1 qt. of cream, pulp it through a lawn sieve, add to it the juice of a lemon and a little sugar, and whisk it till thick. Serve it in a dish or glasses.

To roast fowls the fire must be quick and clear. If smoky, it will spoil both their taste and looks. Baste frequently, and keep a white paper pinned on the breast till it is near done.

TURKEY.—A good sized turkey should be roasted 2 $\frac{1}{2}$ hours or 3 hours—very slowly at first. If you wish to make plain stuffing, pound a cracker or crumble some bread very fine, chop some raw salt pork very fine, sift some sage, (and summer-savory, or sweet-majoram, if you have them in the house, and fancy them,) and mould them all together, seasoned with a little pepper. An egg worked in makes the stuffing cut better.

BOILED TURKEY.—Clean the turkey, fill the crop with stuffing, and sew it up. Put it over the fire in water enough to cover it, let it boil slowly—take off all the scum. When this is done, it should only simmer till it is done. Put a little salt into the water, and dredge the turkey with flour before boiling.

ROAST DUCKS AND GEESE.—Take sage, wash and pick it, and an onion; chop them fine, with pepper and salt, and put them in the belly, let the goose be clean picked, and wiped dry with a cloth, inside and out; put it down to the fire, and roast it brown. Ducks are dressed in the same way. For wild ducks, teal, pigeons, and other wild fowl, use only pepper and salt, with gravy in the dish.

ROAST CHICKEN.—Chickens should be managed in roasting the same as turkeys, only that they require less time. From an hour to an hour and a half is long enough.

BOILED CHICKEN.—A chicken should be boiled the same as a turkey, only it will take less time—about 35 minutes is suffi-

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cient. Use the same stuffing, if any, and serve it up with parsley, or egg-sauce.

BROILED CHICKEN.—Slit them down the back and season with pepper and salt; lay them on a clear fire of coals, the inside next the fire till half done, then turn, and broil to a fine brown color. Broil about 35 minutes.

BOILED PIGEONS.—Boil them about 15 minutes by themselves; then boil a piece of bacon; serve with slices of bacon and melted butter.

FISH CHOWDER.—Fry a few slices of salt pork, dress and cut the fish in small pieces, pare and slice the potatoes and onions, then place them in the kettle, a layer of fish, then of the fried pork, potatoes, onions, &c., seasoning each layer with salt and pepper. Stew over a slow fire 30 minutes.

ROAST BEEF.—The sirloin is considered the best for roasting. Spit the meat, pepper the top, and baste it well while roasting with its own dripping, and throw on a handful of salt. When the smoke draws to the fire, it is near enough; keep the fire bright and clear. From 15 to 20 minutes to the lb., is the rule for roasting.

BEEF BOILED.—The round is the best boiling piece. Put the meat in the pot, with water enough to cover it; let it boil very slow at first—this is the great secret of making it tender—take off the scum as it rises. From 2 to 3 hours, according to size, is the rule for boiling.

BEEF STEAK.—The inside of the sirloin makes the best steak; cut about $\frac{3}{4}$ of an inch thick—have the gridiron hot, put on the meat and set it over a good fire of coals—turn them often. From 8 to 10 minutes is the rule for broiling.

ROAST PORK.—Take a leg of pork and wash it clean—cut the skin in squares—make a stuffing of grated bread, sage, onion, pepper and salt, moistened with the yolk of an egg. Put this under the skin of the knuckle, and sprinkle a little powdered sage into the rind where it is cut; rub the whole surface of the skin over with a feather dipped in sweet oil. 8 lbs. will require about three hours to roast it.

THE SHOULDER, LOIN, or CHINE, and SPARE-RIB are roasted in the same manner.

ROAST VEAL.—Pursue about the same course as in roasting pork. Roast before a brisk fire till it comes to a brown color; when you lay it down baste it well with good butter, and when near done, with a little flour.

ROAST MUTTON.—The loin, haunch, and saddle of mutton and lamb must be done the same as beef. All other parts must be roasted with a quick, clear fire; baste it when you put it down, and dredge it with a little flour, just before you take it up. A leg of mutton of six pounds will require 1 hour to roast before a quick fire.

To BOIL EGGS.—In 3 minutes an egg will boil soft, in 4 the white part is completely cooked, in 10, it is fit for a salad. Try their freshness in cold water, those that sink the soonest are the freshest.

SAUSAGE MEAT.—Take 2 lbs. lean meat, 1 lb. fat-pork, chop fine,

and mix with 2 teaspoonfuls of black pepper, 1 of cloves, 7 of powdered sage, and 5 of salt.

APPLE CUSTARD.—Take apples, pared, cored, and slightly stewed, sufficient to cover the dish, 8 eggs, 1 qt. of milk; spice to your taste; bake it $\frac{1}{2}$ of an hour.

NEW-ENGLAND APPLE-SAUCE OR BUTTER.—Boil 2 brls. of new cider down to $\frac{1}{2}$ a brl. Pare, core, and slice up 3 bushels of apples (sweet apples are preferable), and put them into the cider thus reduced, and still kept boiling briskly. Stir the whole mass constantly, to prevent burning, till of the consistence of soft butter. A small quantity of pulverized allspice, added during the boiling, is an improvement. Boil in a brass kettle, and, when done, put it into a wooden firkin, or small cask, and it will keep for years.

APPLE BUTTER (Pennsylvania Method).—Boil new cider down to $\frac{1}{2}$. Pare, cut, and core equal quantities of sweet and sour apples. Put the sweet apples in a large kettle to soften a little first, as they are the hardest. Add enough boiled cider to cook them. After boiling $\frac{1}{2}$ an hour, stirring often, put in the sour apples, and add more boiled cider, with molasses enough to sweeten moderately. Boil until tender, stirring to prevent burning. Pack in firkins or stone pots for winter use.

IRISH STEW.—Take 4 lbs. good breast of fat mutton, cut in small pieces; 2 large white onions; 10 large potatoes, well peeled and sliced; put all in saucepan together, with fine herbs, pepper and salt to suit; a little salt pork is a good addition; $\frac{1}{2}$ lb. of flour; $\frac{1}{2}$ lb. good fresh butter, well rubbed together, and let it boil for one hour, and have it well cooked.

APPLE DUMPLINGS.—6 eggs, $1\frac{1}{2}$ lbs. of flour, some butter to your taste, and tablespoonful of yeast, and sufficient milk to make a dough to roll-out; when raised, cut in small pieces, put in the apples, and cook for $\frac{3}{4}$ of an hour; serve with white sugar or wine sauce.

BOILED POULTRY.—Take large chickens, well cleaned with cold water, put in saucepan with water to cover, boil 1 hour; served with sauce.

HASHED TURKEY.—Take meat from boiled fowls, chop fine, put in saucepan, with seasoning to suit taste. Served on toast.

BOILED MACCARONI.—Take 2 lbs., break in small pieces, put in warm water to steep 1 hour, drain off, put in saucepan with 2 qts. fresh cream, with grated cheese; seasoned with red pepper.

STRASBURG POTTED MEAT.—Take $1\frac{1}{2}$ lbs. of the rump of beef, cut into dice, put it in an earthen jar, with $\frac{1}{2}$ lb. of butter, tie the jar close up with paper, and set over a pot to boil; when nearly done, add cloves, mace, allspice, nutmeg, salt, and cayenne pepper to taste, then boil till tender, and let it get cold, pound the meat, with 4 anchovies mashed and boned, add $\frac{1}{2}$ lb. of oiled butter, work it well together with the gravy, warm a little, and add cochineal to color, then press into small pots, and pour melted mutton suet over the top of each.

BOLOGNA SAUSAGES.—Take equal quantities of bacon, fat and lean, beef, veal, pork and beef suet; chop them small, season with pepper, salt, &c., with sweet herbs and sage rubbed fine. Have well

washed intestines, fill, and prick them; boil gently for an hour, and lay on straw to dry.

RICH SAUSAGES.—Take 30 lbs. of chopped meat, 3 oz. fine salt, $2\frac{1}{2}$ oz. pepper, 2 tea cups of sage, and $1\frac{1}{2}$ cups of sweet marjoram, passed through a fine sieve, or, if preferred, thyme and summer savory can be substituted for the latter.

HOW TO SAVE YOUR ICE BILL.—Get a quantity of empty barrels or boxes during the coldest time in the winter, and put a few inches of water in each; the evening when the cold is most intense is the best time to do this. After the water is frozen solid, fill up again, repeat the process until the barrels are full of solid ice, then roll them into your cellar, cover them up with plenty of sawdust or straw, and your ice crop is safely harvested.

CHARLOTTE RUSSE.—Take 1 pt. milk, dissolve with heat, 3 oz. isinglass and 1 lb. sugar; add, after it is cool, 1 qt. beaten cream and flour, suit your taste and line out some mould with sponge cake, and put the cream in it and cool.

WINE JELLY.—Take 1 pt. water and 3 oz. isinglass, $1\frac{1}{2}$ lb. sugar, the juice of 2 lemons, and dissolve that and let it come to a boil, then add wine, brandy and spice to your taste, and strain it through a cotton or flannel cloth and put it in moulds to cool.

TO MAKE APPLE MOLASSES.—Take new sweet cider just from the press, made from sweet apples, and boil it down as thick as West-India molasses. It should be boiled in brass, and not burned, as that would injure the flavor. It will keep in the cellar, and is said to be as good, and for many purposes better, than West-India molasses.

Acid fruits should be cooked in bright tin, brass, or bell metal, and poured out as soon as they are done. Brown earthen vessels should never be used, as they are glazed with white lead, a poison which very readily unites with an acid.

JELLIES.—*Lemon Jelly.*—Isinglass, 2 oz.; water, 1 qt.; boil; add sugar, 1 lb.; clarify; and, when nearly cold; add the juice of 5 lemons, and the grated yellow rinds of 2 oranges and 2 lemons; mix well, strain off the peel, and put it into glasses or bottles;

Hartshorn Jelly.—Hartshorn, 1 lb.; water 1 gal.; peel of 2 lemons; boil over a gentle fire till sufficiently thick; strain and add loaf sugar, $\frac{1}{2}$ lb.; whites of 10 eggs beaten to a froth; juice of 6 lemons; mix well together, then bottle. *Isinglass Jelly.*—Put 4 oz. isinglass and 2 oz. cloves into 1 gal. water; boil it down to half a gal.; strain it upon 4 lbs. of loaf sugar; add, while cooling, a little wine; then bottle.

Apple Jelly from Cider.—Take of apple juice, strained, 4 lbs.; sugar, 2 lbs.; boil to a jelly, and bottle. *Gooseberry Jelly.*—Sugar, 4 lbs.; water, 2 lbs.; boil together; it will be nearly solid when cold; to this syrup, add an equal weight of gooseberry juice;

give it a short boil, cool, then pot it. *Currant Jelly.*—Take the juice of red currants, and loaf sugar, equal quantities; boil and stir gently for three hours; put it into glasses; and in three days it will concentrate into a firm jelly.

Tapioca Jelly.—Wash 8 oz. of tapioca well; then soak it in 1 gal. fresh water, five or six hours; add the peels of 8 lemons, and set all on to heat; simmer till clear; add the juice of the 8 lemons with wine and sugar to taste; then bottle.

BLACKBERRY JELLY.—This preparation of the blackberry is more agreeable than the jam, as the seeds, though very wholesome, are not agreeable to all. It is made in the same way as currant jelly; but the fruit is so sweet that it only requires half the weight of the juice in sugar.

PEAR MARMALADE.—To 6 lbs. of small pears, take 4 lbs. of sugar; put the pears into a saucepan, with a little cold water; cover it, and set it over the fire until the fruit is soft, then put them into cold water; pare, quarter, and core them; put to them three tea-cups of water, set them over the fire; roll the sugar fine, mash the fruit fine and smooth, put the sugar to it, stir it well together until it is thick, like jelly, then put it in tumblers, or jars, and, when cold, secure it as jelly.

PRESERVED CITRON.—Pare and cut open the citron; clean all out except the rind; boil till soft. To 1 lb. of citron add 1 lb. of sugar, and a lemon to each lb.; put the sugar and lemon together, and boil it till it becomes a syrup, skimming it well; then put the syrup and citron together, and boil it an hour.

SCOTCH MARMALADE.—Take of the juice of Seville oranges 2 pts., yellow honey, 2 lbs. Boil to a proper consistence.

RASPBERRY JAM.—Allow a pound of sugar to a pound of fruit, mash the raspberries and put them, with the sugar, into your preserving kettle. Boil it slowly for an hour, skimming it well. Tie it up with brandy paper. All jams are made in the same manner.

FRENCH HONEY.—White sugar, 1 lb.; 6 eggs, leaving out the whites of 2; the juice of 3 or 4 lemons, and the grated rind of 2, and $\frac{1}{4}$ lb. of butter; stir over a slow fire until it is of the consistency of honey.

ALMOND BLANC MANGE.—Take four ounces of almonds, six oz. sugar, boil together with a quart of water, melt in this two ounces of pure isinglass, strain in a small tin mould to stiffen it. When wanted, dip the mould in hot water and turn it out.

LEMON BLANC MANGE.—Pour a pint of hot water upon half an ounce of isinglass; when it is dissolved add the juice of three lemons, the peel of two lemons grated, six yolks of eggs beaten, and about a good wine-glass of Madeira wine to it; sweeten to your taste; let it boil; then strain it and put it in your moulds.

MOLASSES PRESERVES.—Boil 1 qt. of molasses about ten or fifteen minutes to a thickish consistency, then add 6 eggs well beaten, and a spoonful of flour. Boil a few minutes longer, stirring constantly, then set off the fire, and flavor with lemon or allspice as desired.

FRUIT EXTRACTS, &c.—Good alcohol, 1 qt. oil of lemon, 2 oz. Break and bruise the peel of 4 lemons, and add to the alcohol for a few days, then filter. For currants, peaches, raspberries, pine apples, strawberries, blackberries &c., take alcohol and water half and half, and pour over the fruit, entirely covering it, and let it stand for a few days. For essence of cinnamon, nutmeg, mace, vanilla, &c., pulverise either article thoroughly, and put about 2 oz. of the resulting powder to each pint of reduced alcohol, agitate the mixture frequently for 2 weeks, then filter and color as desired.

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MEASURES FOR HOUSEKEEPERS.

Wheat flour.....1 lb. ... is 1 quart.	Best brown sugar..... 1 lb. 2 oz. is 1 qt.
Indian meal..... 1 " 2 oz. " 1 quart.	Eggs.....10 eggs are 1 lb.
Butter when soft. 1 "....." 1 "	Flour..... 8 qts. " 1 peck.
Loaf sugar, broken 1 "....." 1 "	Flour..... 4 pks. " 1 bush.
Whitesugar, powd 1 " 1 oz. " 1 "	

LIQUIDS.

16 large tablespoonfuls, are... $\frac{1}{2}$ pint.	4 qts. are 1 gallon.
8 large tablespoonfuls are... 1 gill.	A common sized tumbler holds $\frac{1}{2}$ a pint.
4 large tablespoonfuls, are... $\frac{1}{2}$ gill.	A common sized wine-glass " $\frac{1}{4}$ a gill.
2 gills, are..... $\frac{1}{2}$ pint.	25 drops are equal to 1 teaspoonful.
2 pints, are..... 1 qt.	

FARMERS AND STOCK OWNERS' DEPARTMENT.

SUPERPHOSPHATE OF LIME, THE GREATEST AGRICULTURAL DISCOVERY OF THE AGE.—Take a large puncheon, large tub, or barrel, and put into it 100 lbs. water, add, very slowly and cautiously, 50 lbs. of pure sulphuric acid; you must be very careful, while handling this article, not to let it touch your skin or clothing, as it will instantly blacken the skin, and destroy the clothing, wherever it comes in contact; and, when mixed with water, it engenders a very intense heat. Into this mixture throw 100 lbs. weight of bones, no matter how old or useless they may be. The sulphuric acid instantly attacks and enters into combination with the bones, reducing them to a pasty consistence, and completely dissolving them. Keep under cover, and turn them over occasionally, while the process is going on; and, when completed, dump out the whole contents on the barn floor or on a platform of boards, and thoroughly work into the mass four times its bulk of dry bog-earth or dry road-dust; mix and pulverize completely with a wooden shovel. The bog-earth acts as an absorbent or drier, retaining the fertilizing properties of the compound, and rendering it easy of uniform distribution. If whole bones are used, it will take six or eight weeks to dissolve them; if they are broken with an axe, they will dissolve in about three weeks; if they are ground in a bone mill, four days will be sufficient. This manure is the most powerful fertilizer in existence; and, when made by these directions, it is the cheapest, as one ton is equal to thirty-two tons of barn-yard manure. For top-dressing grass lands, use 300 lbs. per acre; for corn, potatoes, beans, turnips, &c., apply 450 lbs. per acre in the drill, mixing with the soil: for wheat, rye, oats, or barley, 400 lbs. per acre, harrow in with the seed: for buckwheat, 300 lbs. per acre.

SUPERPHOSPHATE IN TWENTY-FOUR HOURS.—Any farmer who has got an apparatus for steaming food for cattle can make superphosphate in quick style by admitting steam from the boiler into

the barrel containing the water, acid, and ground bones. The heat thus generated quickens the dissolution of the bones in a wonderful manner; and, if the process is properly conducted, it will not take over twenty-four hours in any case. It is indispensable that the barrel be tightly covered to retain the steam.

FERTILIZER FOR TOBACCO.—Take and add 30 lbs. of the best Peruvian Guano to each 100 lbs. weight of the superphosphate made by the above receipt, and you will have one of the most powerful fertilizers for tobacco that can be made. If you do not have Peruvian Guano, use in lieu thereof 25 lbs. of hen manure to each 100 lbs. weight of superphosphate.

HOME-MADE POUDRETTE.—Few fertilizers are wasted with the prodigality of extravagance which attends the use of night soil, while the exercise of a little care and attention is all that is required to secure one of the most powerful fertilizers in existence. Night soil contains phosphate of lime, which is essential to the growth of animals' bones, and which is not supplied from the atmosphere like carbonic acid and ammonia. In order to receive the droppings in a manageable and inoffensive state, the vault should be provided with a large, tight box made of matched plank, placed to slide on scantling, so that it can be drawn out, by attaching a horse, whenever required. Provide plenty of dry, black loam from the woods or swamps; refuse charcoal, dry peat, or alluvial deposits answer first-rate. Keep them dry, in barrels or boxes on the spot, under cover; spread a thick layer on the bottom of the receiving box, and at intervals of a few days throw in a liberal supply of these absorbents on the accumulating deposit. If a few handfuls of plaster are thrown in occasionally, it will suppress unpleasant odors, and increase the value of the manure. The emptying of slops and dish water in the box should be strictly prohibited. When the box is filled, you can remove it, and convert it into poudrette. For this purpose it must be worked over with an additional quantity of muck, or other absorbent, in such proportions that it will form, with what has been previously added, about three-quarters of the entire compound. The working should be done under a shed, and the whole kept perfectly dry. It should be shovelled over and mixed several times at intervals, and finally screened, and made as uniform throughout as possible: the finer it is pulverized, and the drier it is kept, the better.

HOME-MADE GUANO OF UNEQUALLED EXCELLENCE.—Save all your fowl manure from sun and rain. To prepare it for use, spread a layer of dry swamp-muck (the blacker it is the better) on your barn floor, and dump on it the whole of your fowl-manure; beat it into a fine powder with the back of your spade; this done, add hard wood ashes and plaster of Paris, so that the compound shall be composed of the following proportions: dried muck, three bushels; fowl-manure, 2 bushels; ashes, 1 bushel; plaster, $1\frac{1}{2}$ bushels. Mix thoroughly, and spare no labor; for, in this matter, the elbow-grease expended will be well paid for. A little before planting, moisten the heap with water, or, better still with urine; cover well over with old mats, and let it lie till wanted for use. Apply it to beans, corn, or potatoes, at the rate of a handful to a hill; and mix with the soil before dropping the seed. This will be found the best

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substitute for guano ever invented, and may be depended on for bringing great crops of turnips, corn, potatoes, &c.

TO DISSOLVE LARGE BONES FOR MANURE, WITHOUT EXPENSE.—Take any old flour-barrel, and put into the bottom a layer of hard-wood ashes; put a layer of bones on the top of the ashes, and add another layer of ashes, filling the space between the bones with them; then add bones and ashes alternately, finishing off with a thick layer of ashes. When your barrel is filled, pour on water (urine is better,) just sufficient to keep them wet, but do not on any account suffer it to leach one drop; for that would be like leaching your dungheap. In the course of time they will heat, and eventually soften down so that you can crumble them with your finger. When sufficiently softened, dump them out of the barrel on a heap of dry loam, and pulverize and crumble them up till they are completely amalgamated into one homogeneous mass with the loam, so that it can be easily handled and distributed whenever required. You may rely on it, this manure will leave its mark, and show good results wherever it is used.

SUBSTITUTE FOR SUPERPHOSPHATE. If you have inch bone ground in a bone-mill, and cannot afford to purchase sulphuric acid to work it up into superphosphate of lime, you can reduce your bones into a fine impalpable powder by simply using three barrels of loamy soil to every barrel of inch bones; mix them together. The bones will soon begin to heat and ferment, and continue so for some time; they will then cool off. You will then proceed to chop down and pulverize and work the mass thoroughly; it will begin to re-heat and ferment and cool down again, and you will continue working it over till the contents are brought to the proper state of fineness, when you will have a fertilizer of astonishing power. It is only a year or two since a statement appeared in the "Country Gentleman," of the experiments of a Mr. HASKELL with a manure prepared after this method, who found it even superior to superphosphate of lime.

HOW TO DOUBLE THE USUAL QUANTITY OF MANURE ON A FARM.—Provide a good supply of black swamp mould or loam from the woods, within easy reach of your stable, and place a layer of this, one foot thick, under each horse, with litter as usual, on the top of the loam or mould. Remove the droppings of the animals every day, but let the loam remain for two weeks; then remove it, mixing it with the other manure, and replace with fresh mould. By this simple means, any farmer can double not only the quantity but also the quality of his manure, and never feel himself one penny the poorer by the trouble or expense incurred, while the fertilizing value of the ingredients absorbed and saved by the loam can scarcely be estimated.

Josiah Quincy, jun., has been very successful in keeping cattle in stables the year through, and feeding them, by means of soiling. The amount of manure thus made had enabled him to improve the fertility of a poor farm of 100 acres, so that in twenty years the hay crop had increased from 20 to 300 tons. The cattle are kept in a well-arranged stable and are let out into the yard an hour or two morning and afternoon; but they generally appear glad to return to their quarters. By this process, one acre enables him to sup-

port three or four cows. They are fed on grass, green oats, corn fodder, barley &c., which are sown at intervals through the spring and summer months, to be cut as required; but he remarks that his most valuable crop is his manure crop. Each cow produces $3\frac{1}{2}$ cords of solid, and 3 cords of liquid manure, or $6\frac{1}{2}$ cords in all. He uses twice as much muck to mix with it, making 20 cords in all. Five to eight miles from Boston, such manure is worth five to eight dollars a cord. From this estimate, he has come to the conclusion that a cow's manure may be made as valuable as her milk.

TWENTY DOLLARS' WORTH OF MANURE FOR ALMOST NOTHING — If you have any dead animal,—say, for instance, the body of a horse,—do not suffer it to pollute the atmosphere by drawing it away to the woods or any other out of the way place, but remove it a short distance only, from your premises, and put down four or five loads of muck or sods, place the carcass thereon, and sprinkle it over with quick-lime, and cover over immediately with sods or mould sufficient to make, with what had been previously added, 20 good waggon-loads; and you will have, within twelve months, a pile of manure worth \$20 for any crop you choose to put it upon. Use a proportionate quantity of mould for smaller animals, but never less than twenty good waggon-loads for a horse, and, if any dogs manifest too great a regard for the enclosed carcass, shoot them on the spot.

FISH COMPOST, SUBSTITUTE FOR BONE-DUST, MANURE FROM FISH REFUSE, &c. — The fish owes its fertilizing value to the animal matter and bone-earth which it contains. The former is precisely similar to flesh or blood, consisting of 25 per cent. of fibrin, the rest being water; and their bones are similar in composition to those of terrestrial animals. As fertilizing agents, therefore, the bodies of fishes will act nearly in the same way as the bodies and blood of animals; 100 lbs., in decaying, produce $2\frac{1}{2}$ lbs. of ammonia. Hence 400 lbs. of fish rotted in compost are enough for an acre. The great effect is due to the ammoniacal portion; for it renders the herbage dark-green, and starts it very rapidly. One of the best composts is made as follows: Dried bog-earth, loam, or peat, seven barrels; hardwood ashes, two barrels; fish, one barrel, slacked lime, one bushel. Place a thick layer of the bog-earth on the bottom, on the top of this put a layer of the fish, then a sprinkling of lime, then a layer of ashes, on top of the ashes put a thick layer of bog-earth, loam, or peat; then another thin layer of fish, lime, and ashes, and so on till your materials are worked in, then top off with a thick layer of the absorbents, to retain the fertilizing gases. The decomposition of the fish will proceed very rapidly, and a very rich compost will be the result. It should be shovelled over and over and thoroughly intermixed and pulverized. Put this on so as to have 400 lbs. of fish to the acre. It may be applied with the greatest benefit to corn, turnips, potatoes, beans, &c., in the drill and broadcast on the grass.

Superphosphate can be made from pogy-chum, or the refuse of other fish, after the oil is expressed, by dissolving in sulphuric acid, and afterwards mixing with dry loam, precisely as directed for making superphosphate with bones. Whale-oil or the oil of any fish, when made into a compost with loam, and a little lime or

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wood ashes, yields a very powerful manure, merely mixed with absorbent earth and applied at the end of the month. Impure whale-oil, at the rate of 40 gallons per acre, has produced a crop of 23½ tons of turnips per acre; while on the same soil, and during the same season, it took 40 bushels of bone-dust to produce only 22 tons per acre.

ASHES FROM SOIL BY SPONTANEOUS COMBUSTION.—Make your mound 21 feet long by 10½ feet wide. To fire, use 72 bushels of lime. First a layer of dry sods or parings on which a quantity of lime is spread, mixing sods with it; then a covering of eight inches of sods, on which the other half of the lime is spread, and covered a foot thick, the height of the mound being about a yard. In twenty-four hours it will take fire. The lime should be fresh from the kiln. It is better to suffer it to ignite itself than to effect it by the operation of water. When the fire is fairly kindled, fresh sods must be applied; but get a good body of ashes in the first place. I think it may be fairly supposed that the lime adds full its worth to the quality of the ashes, and, when limestone can be got, I would advise the burning a small quantity in the mounds, which would be a great improvement to the ashes, and would help to keep the fire in.

SUBSTITUTE FOR BARN-MANURE.—Dissolve a bushel of salt in water enough to slack 5 or 6 bushels of lime. The best rule for preparing the compost heap is, 1 bushel of this lime to 1 load of swamp-muck, intimately mixed; though 3 bushels to 5 loads makes a very good manure. In laying up the heap, let the layer of muck and lime be thin, so that decomposition may be more rapid and complete. When lime cannot be got, use unleached ashes,—3 or 4 bushels to a cord of muck. In a month or six weeks, overhaul and work over the heap, when it will be ready for use. Sprinkle the salt water on the lime as the heap goes up.

SHEEP-DIPPING COMPOSITION.—Water, 1 gal.; benzine, 8 ounces; cayenne pepper, 2 ounces. Mix; make what quantity you require, using these proportions. Dip your sheep and lambs in the composition, and it will make short work of the vermin.

OAT OR WHEAT STRAW MADE EQUAL TO HAY.—Bring 10 gallons water to a boiling heat; take it off the fire, and add to it at once 8 gallons of linseed unground; let it remain till it gets cold; then empty the whole into a cask, containing 44 gallons of cold water, and let it remain for forty-eight hours. At the end of that time, it will be reduced into a thin jelly, like arrowroot. Spread out ½ ton straw, and sprinkle it over regularly with the whole of the liquid from the cask. The stock will eat it up as clean, and keep as fat on it, quantity for quantity, as they would do on hay.

DEATH FOR VERMIN ON PLANTS OR ANIMALS.—Pour a gallon of boiling water on one pound tobacco leaves, strain it in twenty minutes; for vermin, on animals or plants, this decoction is certain death.

REMEDY FOR CURCULIO IN FRUIT TREES.—Sawdust saturated in coal oil, and placed at the roots of the tree, will be a sure preventive; or, clear a circle around the tree from all rubbish; fill up all little holes and smooth off the ground for a distance of at least 3 feet each way from the tree, then place chips or small pieces of

wood on the ground within the circle; the curculio will take refuge in large numbers below the chips, and you can pass around in the mornings and kill them off.

GRAFTING WAX.—Rosin, 1 lb.; bees-wax, 1 lb.; with tallow or lard sufficient to soften until it can be readily applied with the hand; melt.

DR. COLE'S KING OF OILS.—1 oz. green copperas; 2 oz. white vitriol, 2 oz. common salt; 2 oz. linseed oil; 8 oz. molasses. Boil over a slow fire fifteen minutes, in a pint of urine; when almost cold, add 1 oz. of oil of vitriol and 4 oz. of spirits turpentine. Apply to wounds with a feather. A very powerful liniment.

SLOAN'S HORSE OINTMENT.—4 oz. rosin; 4 oz. bees-wax; lard, 8 oz.; honey, 2 oz. Mix slowly and gently bring to a boil; then add less than 1 pint spirits turpentine; then remove, and stir till cool. Unsurpassed for horse-flesh, cracked hoofs, human flesh, &c.

MEXICAN MUSTANG LINIMENT.—Petroleum, olive oil, and carbonate of ammonia, each equal parts; and mix. It is one of the best liniments in use.

MERCHANT'S GARGLING OIL.—Take $2\frac{1}{2}$ gals. linseed oil; $2\frac{1}{2}$ gals. spirits turpentine; 1 gal. western petroleum; 8 oz. liquor potass. sap green, 1 oz. Mix all together, and it is ready for use.

ARABIAN CONDITION POWDERS.—Ground ginger, 1 lb.; sulphuret of antimony, 1 lb.; powdered sulphur, 1 lb.; saltpetre, 1 lb. Mix all together; and administer in a mash, in such quantities as may be required. The best condition powder in existence.

BLISTERING LINIMENT.—1 part Spanish flies, finely powdered; 3 of lard; and 1 of yellow rosin. Mix the lard and rosin together, and add the flies when the other ingredients begin to cool. To render it more active, add 1 pint spirits turpentine.

MEDICATED FOOD FOR HORSES AND CATTLE.—Take linseed cake and pulverize or grind it up in the shape of meal, and to every 50 lbs. of this ingredient, add 10 lbs. Indian meal; 2 lbs. sulphuret of antimony; 2 lbs. ground ginger. $1\frac{1}{2}$ lbs. of saltpetre, and 2 lbs. powdered sulphur. Mix the whole thoroughly together, put up in neat boxes or packages for sale or otherwise as desired, and you will have an article equal in value to "Thorley's Food," or almost any other preparation that can be got up for the purpose of fattening stock, or curing disease in every case when food or medicine can be of any use whatever. This article can be fed in any desired quantity, beginning with a few tablespoonfuls at a time, for a horse, mixing it with his grain, and in the same proportion to smaller animals, repeating the dose and increasing the quantity as the case may seem to require.

LOTION FOR MANGE.—Boil 2 oz. tobacco in 1 quart water; strain; add sulphur and soft soap, each 2 oz.

FOR STRAINS AND SWELLINGS.—Strong vinegar saturated with common salt, used warm, is good for strains and reducing swellings. 1 oz. of white vitriol; 1 oz. of green copperas; 2 teaspoonfuls of gunpowder, all pulverized together, and dissolved in 1 quart of soft water, and used cold, rubbing in thoroughly, is one of the best applications known for reducing swellings.

HOOF-BOUND WASH.—Spirits turpentine, 4 oz.; tar, 4 oz.; whale-oil, 8 oz. Mix, and apply to the hoofs often.

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TO TOUGHEN HOOF.—Wash them frequently in strong brine, and turn brine upon the bottoms, and soak a few minutes each time.

SCRATCHES.—Cut off the hair close, and wash the legs in strong soap-suds or urine, or wash with warm vinegar saturated with salt, and afterwards dress over with a small quantity of hog's lard.

COUGH.—Quit feeding musty hay, and feed roots and laxative food. Sprinkle human urine on his fodder, or cut up cedar boughs and mix with his grain; or boil a small quantity of flax-seed, and mix it in a mash of scalded bran, adding a few ounces of sugar, molasses, or honey. Administer lukewarm. If there should be any appearance of *heaves*, put a spoonful of ground ginger once per day in his provender, and allow him to drink freely of lime water.

SPLIT OR BROKEN HOOF.—Let the blacksmith bore two holes on each side of the crack or split; pass long nails through the holes, and clinch tight. After anointing with the hoof-bound liquid, it will soon grow together.

COLIC CURE.—Bleed freely at the horse's mouth; then take $\frac{1}{2}$ lb. raw cotton, wrap it around a coal of fire, so as to exclude the air; when it begins to smoke, hold it under his nose till he becomes easy.

TO CURE DISTEMPER.—Take $1\frac{1}{4}$ gals. of blood from the neck vein; then administer sassafras oil, $1\frac{1}{2}$ oz. Cure, speedy and certain.

FOUNDER CURED IN 24 HOURS.—Boil or steam stout oat-straw for half-an-hour, then wrap it around the horse's leg quite hot, cover up with wet woollen rags to keep in the steam; in 6 hours renew the application, take 1 gal. of blood from the neck vein, and give 1 quart linseed oil. He may be worked next day.

CURE FOR STAGGERS.—Give a mess twice a week, composed of bran, 1 gal.; sulphur, 1 tablespoonful; saltpetre, 1 spoonful; boiling sassafras tea, 1 quart; assafoetida, $1\frac{1}{2}$ oz. Keep the horse from cold water for half a day afterwards.

RING-BONE AND SPAVIN.—Take sweet oil, 4 oz.; spirits turpentine, 2 oz.; oil of stone, 1 oz. Mix, and apply three times per day. If the horse is over four years old, or in any case when this is not sufficient, in addition to it, you will fit a bar of lead just above it, wiring the ends together, so it constantly wears upon the enlargement; and the two together will cure nine cases out of every ten, in six weeks.

POLL EVIL AND FISTULA.—Common potash dissolved in $\frac{1}{2}$ pint of water, 1 lb.; add $\frac{1}{2}$ oz. belladonna extract, and 1 oz. gum arabic dissolved in a little water; work all into a paste with wheat flour, and bottle up tight. Directions: wash the sores well with Castile soap-suds; then apply tallow all around them. Next, press the above paste to the bottom of all the orifices; repeat every two days till the callous fibrous base around the poll evil or fistula is completely destroyed; put a piece of oil-cloth over the sores, and afterwards heal up with Sloan's Horse Ointment.

T. TAME HORSES.—Take finely-grated horse castor, oils of rhodium and cummin; keep them in separate bottles well-corked; put some of the oil cummin on your hand, and approach the horse on the windy side. He will then move toward you. Then rub

some of the cummin on his nose, give him a little of the castor on anything he likes, and get eight or ten drops oil rhodium on his tongue. You can then get him to do anything you like. Be kind and attentive to the animal, and your control is certain.

BEST REMEDY FOR HEAVES.—Balsam of fir and balsam of copaiba, 4 oz. each, and mix with calcined magnesia sufficiently thick to make it into balls; and give a middling-sized ball night and morning for a week or ten days.

CURE FOR BOTS IN HORSES.—Give the horse, first, 2 quarts of new milk, and 1 quart molasses; 15 minutes afterwards, give 2 quarts very strong sage tea; 30 minutes after the tea, give 3 pints (or enough to operate as physic), of curriers' oil. The molasses and milk cause the bots to let go their hold, the tea puckers them up, and the oil carries them completely away. Cure certain, in the worst cases.

CERTAIN RING-BONE AND SPAVIN CURE.—Venice turpentine and Spanish flies, of each 2 oz.; euphorbium and aqua-ammonia, of each 1 oz.; red precipitate, $\frac{1}{2}$ oz.; corrosive sublimate, $\frac{1}{4}$ oz.; lard, $1\frac{1}{2}$ lbs. Pulverize all, and put into the lard; simmer slowly over coals, not scorching or burning; and pour off, free of sediment. For ring-bones, cut off the hair, and rub the ointment well into the lumps once in 48 hours. For spavins, once in 24-hours for 3 mornings. Wash well previous to each application with suds, rubbing over the place with a smooth stick, to squeeze out a thick, yellow matter. This has removed very large ring-bones.

BONE SPAVINS, FRENCH PASTE.—\$300 RECIPE.—Corrosive sublimate, quicksilver, and iodine, of each 1 oz. Rub the quicksilver and iodine together; then add the sublimate, and lastly the lard, rubbing them thoroughly. Shave off the hair the size of the bone enlargement; grease all around it, but not where the hair is shaved off, this prevents the action of the medicine, except on the spavin. Then rub in as much of the paste as will lie on a 3 cent piece, each morning, for 3 or 4 mornings. In from 7 to 8 days, the whole spavin will come out; then wash the wound with suds for an hour or so, to remove the poisonous effects of the paste; afterwards heal up the sore with any good healing salve, or Sloan's Horse Ointment, as per recipe above, keeping the sore covered while it is healing up.

ANOTHER VERY VALUABLE RECIPE FOR RING-BONE.—Pulverized cantharides, oils of spike, origanum, amber, cedar, Barbadoes tar, and British oil, of each 2 oz.; oil of wormwood, 1 oz.; spirits turpentine, 4 oz.; common potash, $\frac{1}{2}$ oz.; nitric acid, 6 oz.; sulphuric acid, 4 oz.; lard, 3 lbs. Melt the lard, and slowly add the acids; stir well, and add the other articles, stirring till cold; clip off the hair, and apply by rubbing and heating in. In about 3 days, or when it is done running, wash off with soap-suds, and apply again. In old cases, it may take 3 or 4 weeks; but, in recent cases, 2 or 3 applications have cured.

ANOTHER.—Pulverized cantharides, oils of origanum and amber, and spirits turpentine, of each 1 oz.; olive oil, $\frac{1}{2}$ oz.; sulphuric acid, 3 drams; put all, except the acid, into alcohol; stir the mixture, add the acid slowly, and continue to stir till the mixture ceases to smoke; then bottle for use. Apply to ring-bone or spavin

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with a sponge tied on the end of a stick, as long as it is absorbed into the parts; twenty-four hours after, grease well with lard; and in twenty-four hours more, wash off well with soap-suds. One application is generally sufficient for spavins, but may need two; ring-bones, always two or three applications, three or four days apart, which prevents loss of hair. This will stop all lameness, but does not remove the lump.

SPLINT AND SPAVIN LINIMENT.—Oil of origanum, 6 oz.; gum camphor, 2 oz.; mercurial ointment, 2 oz.; iodine ointment, 1 oz.; melt by putting all into a wide-mouthed bottle, and setting it in a kettle of hot water. Apply it to bone spavins or splints, twice daily, for four or five days, and a cure is guaranteed.

LINIMENT FOR SWENY.—Alcohol and spirits turpentine, of each, 8 oz.; camphor-gum, pulverized cantharides, and capsicum, of each 1 oz.; oil of spike, 3 oz.; mix. Bathe this liniment in with a hot iron, and a certain cure is sure to follow.

FOR LOOSENESS OR SCOURING IN HORSES OR CATTLE.—Tormentil root, powdered. Dose for a horse or cow, 1 to 1½ oz. It may be stirred into 1 pint of milk, and given; or it may be steeped in 1½ pints of milk, then given from three to six times daily, until cured.

SCOURS AND PIN-WORMS IN HORSES AND CATTLE.—White-ash bark burnt into ashes, and made into a rather strong lye; then mix ½ pint of it with 1 pint warm water, and give all two or three times daily. This will certainly carry off the worms, which are the cause, in most instances, of scours and looseness.

ENGLISH STABLE LINIMENT, VERY STRONG.—Oil of spike, aqua-ammonia, and oil of turpentine, each 2 oz.; sweet oil, and oil of amber, each 1½ oz.; oil of origanum, 1 oz. Mix.

COLIC CURE FOR HORSES AND PERSONS.—Spirits turpentine, 3 oz.; laudanum, 1 oz.; mix; and for a horse give all for a dose, by putting it into a bottle with half a pint of warm water. If relief is not obtained in an hour, repeat the dose, adding half an ounce of the best powdered aloes, well dissolved. Cure, certain.

FOR PERSONS, a dose would be from 1 to 2 teaspoonfuls in warm tea; children or weak persons, less.

LINIMENT FOR FIFTY CENTS PER GALLON.—Best vinegar, 2 quarts; pulverized saltpetre, ½ lb.; mix, and set in a cool place till dissolved. Invaluable for old swellings, sprains, bruises, &c.

SHOEING HORSES.—A smith who shod for the hunt, and who said that he would have to shut up shop if a shoe was lost, as it might cause the loss of a horse worth a thousand pounds, fastened the shoe as follows:—As he drove the nails, he merely bent the points down to the hoof, without twisting them off, as the usual practice is; he then drove the nails home, and clinched them. He then twisted off the nails, and filed them lightly to smooth them, thus having, as he remarked, a clinch and rivet to hold the nails.

HORSE AIL.—Make a slow fire of old shoes, rags, herbs, &c. When fired a little, smother so as to make a great smoke and steam; then set a barrel without heads, over the fire, and hold the horse's head down in the barrel, and smoke him well. This will soon produce a copious running at the nose, and he will be so well pleased that he will voluntarily hold his head in the smoke. Continue this half an hour or more daily, meanwhile give him potatoes and

warm bran mashes, and gentle physic, if there be much costiveness which the laxative food will not remove. If he has much fever treat him for that.

SADDLE AND HARNESS GALLS, &c.—White lead and linseed oil, mixed as for paint, is almost unrivalled for healing saddle, harness, or collar galls and bruises. Try it, applying with a brush. It soon forms an air-tight coating and soothes the pain, powerfully assisting nature.

GREASE HEEL.—Lye made from wood-ashes, and boil white-oak bark in it till it is quite strong, both in lye and bark-ooze; when it is cold, it is fit for use. Wash off the horse's legs with Castile soap; when dry, apply the above lye with a swab fastened on a long stick to keep out of his reach, as the smart caused by the application might make him let fly without much warning; but it is a sure cure, only it brings off the hair. To restore the hair after the cure is effected, make and apply a salve by stewing elder bark in old bacon; then form the salve by adding a little resin, according to the amount of oil when stewed, or $\frac{1}{4}$ lb. resin to each pound of oil.

VALUABLE REMEDY FOR HEAVES.—Calcined magnesia, balsam of fir, balsam copaiba, of each 1 oz.; spirits turpentine, 2 oz.; put them all into 1 pint best cider vinegar; give for a dose, 1 table-spoonful in his feed, once a day for a week; then every other day for 2 or 3 months. Wet his hay with brine, and also his other feed. He will cough more at first, but looser and looser till cured.

TO DISTINGUISH AND CURE DISTEMPER.—Wet up bran with rather strong lye; if not too strong, the horse will eat it greedily. If they have the distemper, a free discharge from the nostrils, and a consequent cure, will be the result, if continued a few days; but, if only a cold, with swellings of the glands, no change will be discovered.

REMEDY FOR FOUNDER.—Draw about 1 gallon blood from the neck; then drench the horse with linseed oil, 1 quart; now rub the fore-legs long and well with water as hot as can be borne without scalding.

PHYSIC-BALL FOR HORSES.—Barbadoes aloes, from 4 to 5 or 6 drams (according to size and strength of the horse); tartrate of potassa, 1 dram; ginger and Castile soap, each, 2 drams; oil of anise, or peppermint, 20 drops; pulverize and make all into one ball, with thick gum solution. Feed by giving scalded bran instead of oats, for two days before giving the physic, and during its operation.

PHYSIC FOR CATTLE.—Take *half* only of the dose above for a horse, and add to it glauher-salts, 8 oz.; dissolve all in gruel, 1 quart, and give as a drench.

HOOF-AIL IN SHEEP.—Muratic acid and butter of antimony, of each 2 oz.; white vitriol, pulverized, 1 oz.; mix. Lift the foot, and drop a little of it on the bottom, only once or twice a week. It kills the old hoof, and a new one soon takes its place.

TO CULTIVATE TOBACCO.—To raise tobacco, select a sheltered situation, where the young plants can receive the full force of the sun; burn over the surface of the ground early in spring (new land is best), rake it well, and sow the seeds: have a dry, mellow,

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rich soil, and after a shower, when the plants have got leaves the size of a quarter-dollar, transplant as you would cabbage plants, 34 feet apart, and weed out carefully afterwards. Break off the suckers from the foot-stalks, as they appear; also the tops of the plants when they are well advanced,—say, about 3 feet high, —except those designed for seed, which should be the largest and best plants. The ripeness of tobacco is known by small dusky spots appearing on the leaves. The plants should then be cut near the roots, on the morning of a day of sunshine, and should lie singly to wither. When sufficiently withered, place the plants in close heaps, under cover, to sweat 48 hours or more; then hang them up under cover to dry.

TO PRESERVE POTATOES FROM ROT.—Dust over the floor of the bin with lime, and put in about 6 or 7 inches of potatoes, and dust with lime as before, then more potatoes, using about 1 bushel of lime to 40 bushels of potatoes. The lime improves the flavor of the potatoes, and effectually kills the fungi which causes the rot.

An old veteran farmer, with 63 years' experience, has successfully fought the potatoe rot *in the ground*, as follows. He plants them in the latter part of April, or beginning of May, and in the old of the moon. When six inches high, they are plastered and dressed out nicely. Now for the secret. When blossoming, take 2 parts plaster, and 1 part fine salt, mix well together, and put 1 large spoonful of this compound as near the centre of each hill as possible. When ripe, take them out of the ground, have them dry when put in the cellar, and keep them in a dry, cool place.

PACKING FRUITS FOR LONG DISTANCES.—Take a box of the proper size, soft paper, and sweet bran. Place a layer of bran on the bottom, then each bunch of grapes is held by the hand over a sheet of the paper; the four corners of the paper are brought up to the stalk and nicely secured; then laid on its side in the box, and so on until the first layer is finished. Then dust on a layer of bran, giving the box a gentle shake as you proceed. Begin the second layer as the first, and so on until the whole is full. The bloom of the fruit is thus preserved as fresh at the end of a journey of 500 miles as if they were newly taken from the tree. Never fails to preserve grapes, peaches, apricots and other fruit.

TO SPROUT ONIONS.—Pour hot water on the seed, let it remain 2 or 3 seconds, and they will immediately sprout, and come up much earlier.

TO RENEW OLD ORCHARDS.—Early in the spring, plough the entire orchard, and enrich the whole soil with a good dressing of compost of manure, swamp-muck, and lime; scrape off the old bark with a deck-scraper, or a sharp hoe; apply half a bushel of lime, and the same of ground charcoal round each tree. Then apply diluted soft soap, or strong soap-suds, on the trunks and limbs, as high as a man can reach. When the trees are in full bloom, throw over them a good proportion of fine slacked lime, and you will reap abundant fruits from your labors.

TO DESTROY THE MOTH OR MILLER.—Dr. Waterman says, "I took two white dishes (because white attracts their attention in the night) or deep plates, and placed them on the top of the hives, and filled them about half-full of sweetened vinegar. The next

morning I had about 50 millers caught; the second night I caught 50 more; the third night, being cold, I did not get any; the fourth night, being very warm, I caught about 400; the fifth night I got about 200."

TO KEEP MILK SWEET, AND SWEETEN SOUR MILK.—Put into the milk a small quantity of carbonate of magnesia.

TO MAKE CHEAP AND GOOD VINEGAR.—To eight gallons of clear rain-water, add 6 quarts of molasses; turn the mixture into a clean, tight cask, shake it well two or three times, and add 1 pt. of good yeast. Place the cask in a warm place, and in ten or fifteen days add a sheet of common wrapping-paper, smeared with molasses, and torn into narrow strips; and you will have good vinegar. The paper is necessary to form the "mother," or life of the liquor.

MR. CULLEY'S RED SALVE, TO CURE THE ROT IN SHEEP.—Mix 4 oz. of the best honey, 2 oz. of burnt alum reduced to powder, and $\frac{1}{2}$ a pound of Armenian bole, with as much train or fish oil as will convert these ingredients into the consistence of a salve. The honey must first be gradually dissolved, when the Armenian bole must be stirred in; afterwards the alum and train-oil are to be added.

TO IMPROVE THE WOOL OF SHEEP, BY SMEARING.—Immediately after the sheep are shorn, soak the roots of the wool that remains all over with oil, or butter, and brimstone; and, 3 or 4 days afterwards, wash them with salt and water. The wool of next season will not be much finer, but the quantity will be in greater abundance. It may be depended upon, that the sheep will not be troubled with the scab or vermin that year. Salt water is a safe and effectual remedy against maggots.

TO MARK SHEEP WITHOUT INJURY TO THE WOOL.—To 30 spoonfuls of linseed oil, add 2 oz. of litharge, and 1 oz of lampblack; boil all together, and mark the sheep therewith.

TO PREVENT THE FLY IN TURNIPS.—From experiments lately made, it has been ascertained that lime sown by hand, or distributed by a machine, is an infallible protection to turnips against the ravages of this destructive insect. It should be applied as soon as the turnips come up, and in the same daily rotation in which they were sown. The lime should be slacked immediately before it is used, if the air be not sufficiently moist to render that operation unnecessary.

COLORING FOR CHEESE.—The coloring for cheese is, or at least should be, Spanish annatto; but, as soon as coloring became general in this country, a color of an adulterated kind was exposed for sale in almost every shop. The weight of a guinea and a half of real Spanish annatto is sufficient for a cheese of fifty pounds' weight. If a considerable part of the cream of the night's milk be taken for butter, more coloring will be requisite. The leaner the cheese is, the more coloring it requires. The manner of using annatto is to tie up in a linen rag the quantity deemed sufficient, and put it into $\frac{1}{2}$ pt. of warm water over night. This infusion is put into the tub of milk in the morning with the rennet infusion; dipping the rag into the milk, and rubbing it against the palm of the hand as long as any color runs out. The yolk of egg will color butter

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COMPOSITION FOR DRIVING OUT RATS, ETC.—Keep on hand a quantity of chloride of lime. The whole secret consists in scattering it dry all around their haunts and into their holes, and they will leave at once, or a liberal decoction of coal tar placed in the entrance of their holes will do as well.

HOW TO FORM SPRINGS.—The finest springs can be made by boring, which is performed by forcing an iron rod into the earth by its own weight, turning it round, and forcing it up and down by a spring-pole contrivance. The water will sometimes spout up several feet above the surface. Lead pipes are put down in the hole after the water is found. Depressed situations, having a southern exposure, with rising ground towards the north, are the best situations in the United States or the Canadas to find water.

TO BURN LIME WITHOUT A KILN.—Make a pyramidal pile of large limestones, with an arched furnace next the ground for putting in the fuel, leaving a narrow vent or funnel at the top; now cover the whole pile with earth or turf, in the way that charcoal heaps are covered, and put in the fire. The heat will be more completely diffused through the pile, if the aperture in the top is partially closed. Produces a superior article of lime.

EYE WATER FOR HORSES AND CATTLE.—Alcohol, 1 tablespoonful; extract of lead, 1 teaspoonful; rain water, $\frac{1}{2}$ pint.

TO DESTROY MOSS ON TREES.—Paint them with white-wash made of quick lime and wood ashes.

TO PROTECT FRUIT-TREES FROM ATTACK OF MICE, ETC.—Tar, 1 part; tallow, 3 parts; mix. Apply hot to the bark of the tree with a paint brush.

TO PREVENT DECAY OF FARM IMPLEMENTS.—When not in use, have them sheltered from the sun, wind, rain, and snow. By this means, sleighs, waggons, carts, ploughs, threshing-machines, harrows, and the like, would last twice as long as they would if left in the open air, swelling from moisture one week, and shrinking the next, from the influence of the sun and wind.

OILING OR CLEANING OLD CARRIAGES.—Enamel leather-tops should be first washed with Castile soap and warm water, then oiled with neat's foot oil; or sweet oil and a coat of enamel varnish put on, the leather will look like new. Dashes may be cleaned in the same manner, but varnish color is not very beneficial to patent leather; however, when old and cracked, it may be colored to improve the appearance.

DYERS, BLEACHERS, AND CLOTHIERS' DEPARTMENT.

DYEING.—It may be necessary to remark, and I do it here once for all, that every article to be dyed, as well as everything used about dyeing, should be perfectly clean.

In the next place, the article to be dyed should be well scoured in soap, and then the soap rinsed out. It is also an advantage to dip the article you wish to dye into warm water, just before put-

ting it into the alum or other preparation ; through neglect of this precaution, it is nothing uncommon to have the goods, or yarn spotted. *Soft* water should always be used if possible, and sufficient to cover the goods handsomely.

As soon as an article is dyed it should be aired a little, then well rinsed, and afterwards hung up to dry.

When dyeing or scouring silk or merino dresses, care should be taken not to wring them; for this has a tendency to wrinkle and break the silk.

In putting the dresses and shawls out to dry, that have been dyed, they should be hung up by the edge so as to dry evenly.

CHROME BLACK.—FOR WOOLLEN GOODS.—For 5 lbs. of goods, blue vitriol, 6 oz. ; boil it a few minutes ; then dip the goods $\frac{1}{2}$ of an hour, airing often; take out the goods, and make a dye with logwood, 3 lbs. ; boil $\frac{1}{2}$ hour ; dip $\frac{1}{2}$ of an hour, and air the goods, and dip $\frac{1}{2}$ of an hour more. Wash in strong suds. This will not impart any of its color in fulling, nor fade by exposure to the sun.

BLACK ON WOOL.—FOR MIXTURES.—For 10 lbs. of wool, bichromate of potash, 4 oz. ; ground argal, 3 oz. ; boil together, and put in the wool ; stir well, and let it remain in the dye 4 hours. Then take out the wool, rinse it slightly in clear water ; then make a new dye, into which put logwood, $3\frac{1}{2}$ lbs. Boil 1 hour, and add chamber-lye, 1 pt., and let the wool lie in all night. Wash in clear water.

STEEL MIXED.—**DARK.**—Black wool, it may be natural or colored, 10 lbs. ; white wool, $1\frac{1}{2}$ lbs. Mix evenly together, and it will be beautiful.

SNUFF BROWN.—**DARK FOR CLOTH OR WOOL.**—For 5 lbs. goods, camwood, 1 lb. ; boil it 15 minutes, then dip the goods for $\frac{1}{2}$ of an hour ; take out the goods, and add to the dye, fustic, $2\frac{1}{2}$ lbs. ; boil 10 minutes, and dip the goods $\frac{1}{2}$ hour ; then add blue vitriol, 1 oz. ; copperas, 4 oz. ; dip again $\frac{1}{2}$ hour ; if not dark enough, add more copperas. It is dark and permanent.

WINE COLOR.—For 5 lbs. goods, camwood, 2 lbs. ; boil 15 minutes ; then dip the goods for $\frac{1}{2}$ hour ; boil again, and dip $\frac{1}{2}$ hour ; then darken with blue vitriol, $1\frac{1}{2}$ oz. ; if not dark enough, add copperas, $\frac{1}{2}$ oz.

MADDER RED.—To each lb. of goods, alum, 5 oz. ; red, or cream of tartar, 1 oz. ; put in the goods, and bring your kettle to a boil for $\frac{1}{2}$ an hour ; then air them, boil $\frac{1}{2}$ hour longer ; then empty your kettle, and fill with clean water ; put in bran, 1 pk. ; make it milk warm, and let it stand until the bran rises ; then skim off the bran, and put in madder, $\frac{1}{2}$ lb. ; put in your goods, and heat slowly until it boils and is done. Wash in strong suds.

GREEN.—ON WOOL OR SILK, WITH OAK BARK.—Make a strong yellow dye of yellow oak and hickory bark in equal quantities. Add the extract of indigo, or chemic (which see), 1 tablespoon at a time, until you get the shade of color desired.

GREEN.—WITH FUSTIC.—For each lb. of goods, fustic, 1 lb. : with alum, $3\frac{1}{2}$ oz. Steep until the strength is out, and soak the goods therein until a good yellow is obtained ; then remove the chips, and add extract of indigo or chemic, 1 tablespoon at a time, until the color suits.

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BLUE.—QUICK PROCESS.—For 2 lbs. of goods, alum, 5 oz.; cream of tartar, 3 oz.; boil the goods in this for 1 hour; then throw the goods into warm water, which has more or less of the extract of indigo in it, according to the depth of color desired, and boil again until it suits, adding more of the blue if needed. It is quick and permanent.

STOCKING-YARN, OR WOOL TO COLOR.—BETWEEN A BLUE AND PURPLE.—For 5 lbs. of wool, bichromate of potash, 1 oz.; alum, 2 oz.; dissolve them, and bring the water to a boil, putting in the wool, and boiling 1 hour; then throw away the dye, and make another dye with logwood chips, 1 lb.; or extract of logwood, 2½ oz.; and boil 1 hour. This also works very prettily on silk.

N.B.—Whenever you make a dye with logwood chips, either boil the chips ¼ an hour and pour off the dye, or tie up the chips in a bag, and boil with the wool or other goods; or take 2½ oz. of the extract in place of 1 lb. of the chips; this is less trouble, and generally the better plan. In the above recipe, the more logwood that is used the darker will be the shade.

SCARLET WITH COCHINEAL.—For YARN OR CLOTH.—For 1 lb. of goods, cream of tartar, ¼ oz.; cochineal, well pulverized, ¼ oz.; muriate of tin, 2½ oz.; then boil up the dye, and enter the goods; work them briskly for 10 or 15 minutes, after which boil 1½ hours, stirring the goods slowly while boiling; wash in clear water and dry in the shade.

PINK.—For 5 lbs. of goods, alum, 3 oz.; boil and dip the goods 1 hour; then add to the dye, cream of tartar, 4 oz.; cochineal, well pulverized, 1 oz.; boil well, and dip the goods while boiling, until the color suits.

ORANGE.—For 5 lbs. goods, muriate of tin, 6 tablespoons; argal, 4 oz.; boil and dip 1 hour; then add to the dye, fustic, 2½ lbs.; boil 10 minutes, and dip ¼ hour; and add again to the dye, madder, 1 teacup; dip again ¼ hour.

N.B.—Cochineal, in place of madder, makes a much brighter color, which should be added in small quantities until pleased. About 2 oz.

LAC RED.—For 5 lbs. goods, argal, 10 oz.; boil a few minutes; then mix fine ground lac, 1 lb., with muriate of tin, 1½ lbs.; and let them stand 2 or 3 hours; then add half of the lac to the argal dye, and dip ¼ hour; then add the balance of the lac, and dip again 1 hour, keep the dye at a boiling heat, until the last half hour, when the dye may be cooled off.

PURPLE.—For 5 lbs. goods, cream of tartar, 4 oz.; alum, 6 oz.; cochineal, well pulverized, 2 oz.; muriate of tin, ¼ teacup. Boil the cream of tartar, alum, and tin, 15 minutes; then put in the cochineal, and boil 5 minutes; dip the goods 2 hours; then make a new dye with alum, 4 oz.; Brazil wood, 6 oz.; logwood, 14 oz.; muriate of tin, 1 teacup, with a little chemic; work again until pleased.

SILVER DRAB.—LIGHT.—For 5 lbs. goods, alum, 1 small teaspoon, and logwood about the same amount; boil well together, then dip the goods 1 hour; if not dark enough, add in equal quantities alum and logwood, until suited.

SLATE ON WOOLLEN OR COTTON.—WITH BEECH BARK.—Boil the bark in an iron kettle, skim out the chips after it has boiled sufficiently, and then add copperas to set the dye. If you wish it very dark, add more copperas. This is excellent for stockings.

EXTRACT OF INDIGO OR CHEMIC.—To MAKE.—For good chemic or extract of indigo, take of vitriol, $\frac{1}{2}$ lb., and stir it into indigo, finely ground, 2 oz., continuing the stirring at first for $\frac{1}{2}$ hour; now cover over, and stir 3 or 4 times daily for 2 or 3 days; then put in a crumb of saleratus, and stir it up, and, if it foams, put in more and stir, and add as long as it foams; the saleratus neutralizes any excess of acid; then put into a glass vessel, and cork up tight. It improves by standing. Druggists keep this prepared.

WOOL.—TO CLEANSE.—Make a liquid of water, 8 parts, and urine, 1 part; heat it as hot as you can bear the hand in it; then put in the wool, a little at a time, so as not to have it crowd; let it remain in for 15 minutes; take it out over a basket to drain; then rinse in running water, and spread it out to dry; thus proceed in the same liquor; when it gets reduced, fill it up in the same proportions, keeping it at hand heat all the time, not using any soap.

DARK COLORS.—TO EXTRACT, AND INSERT LIGHT.—This recipe is calculated for carpet rags. In the first place, let the rags be washed clean; the black or brown rags can be colored red, or purple, at the option of the dyer; to do this, take, for every 5 lbs. black or brown rags, muriate of tin, $\frac{3}{4}$ lb.; and the lac, $\frac{1}{2}$ lb., mixed with the same, as for the lac red; dip the goods in this dye 2 hours, boiling $\frac{1}{2}$ of the time; if not red enough, add more tin and lac. The goods can then be made a purple by adding a little logwood; be careful, and put in but a small handful, as more can be added if not enough. White rags make a beautiful appearance in a carpet, by tying them in the skein, and coloring them red, green, or purple; gray rags will take a very good green; the coloring will be in proportion to the darkness of mix.

BLACK.—For 5 lbs. goods, sumach, wood and bark together, 3 lbs.; boil $\frac{1}{2}$ hour, and let the goods steep 12 hours; then dip in lime water, $\frac{1}{2}$ hour; then take out the goods, and let them drip an hour; now add to the sumach liquor, copperas, 8 oz., and dip another hour; then run them through the tub of lime-water again for 15 minutes; now make a new dye with logwood, $2\frac{1}{2}$ lbs., by boiling 1 hour, and dip again 3 hours; now add bichromate of potash, 2 oz., to the logwood dye, and dip one hour. Wash in clear cold water, and dry in the shade. You may say this is doing too much. You cannot get a permanent black on cotton with less labor.

SKY BLUE.—For 3 lbs. goods, blue vitriol, 4 oz.; boil a few minutes; then dip the goods 3 hours, after which pass them through strong lime-water. You can make this color a beautiful brown by putting the goods through a solution of prussiate of potash.

LIME-WATER AND STRONG LIME-WATER.—For COLORING.—Lime-water is made by putting stone lime 1 lb., and strong lime-water, $1\frac{1}{2}$ lbs., into a pail of water, slacking, stirring, and letting

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it stand until it becomes clear, then turn into a tub of water, in which dip the goods.

BLUE ON COTTON OR LINEN.—WITH LOGWOOD.—In all cases, if new, they should be boiled in strong soap-suds or weak lye, and rinsed clean; then for cotton, 5 lbs., or linen, 3 lbs., take bichromate of potash, $\frac{3}{4}$ lb.; put in the goods, and dip 2 hours; then take out, rinse; make a dye with logwood, 4 lbs.; dip in this 1 hour, air, and let stand in the dye 3 or 4 hours, or till the dye is almost cold; wash out, and dry.

BLUE ON COTTON.—WITHOUT LOGWOOD.—For 5 lbs. of rags, copperas, 4 oz.; boil and dip 15 minutes; then dip in strong suds, and back to the dye 2 or 3 times; then make a dye with prussiate of potash, 1 oz.; oil of vitriol, 5 tablespoons; boil 30 minutes, and rinse; then dry.

GREEN.—If the cotton is new, boil in weak lye or strong suds; then wash, and dry; give the cotton a dip in the home-made blue dye-tub until blue enough is obtained to make the green as dark as required, take out, dry, and rinse the goods a little; then make a dye with fustic, $\frac{3}{4}$ lb.; logwood, 3 oz., to each 1 lb. of goods, by boiling the dye 1 hour; when cooled so as to bear the hand, put in the cotton, move briskly a few minutes, and let lie in 1 hour; take out, and let it thoroughly drain; dissolve, and add to the dye, for each lb. of cotton, blue vitriol, $\frac{1}{2}$ oz., and dip another hour; wring out, and let dry in the shade. By adding or diminishing the logwood and fustic, any shade of green may be obtained.

YELLOW.—For 5 lbs. of goods, sugar of lead, 7 oz.; dip the goods 2 hours; make a new dye with bichromate of potash, 4 oz.; dip until the color suits, wring out, and dry; if not yellow enough, repeat the operation.

ORANGE.—For 5 lbs. of goods, sugar of lead, 4 oz.; boil a few minutes, and when a little cool put in the goods, dip 2 hours, wring out; make a new dye with bichromate of potash, 8 oz.; madder, 2 oz.; dip until it suits; if the color should be too red, take off a small sample, and dip it into lime-water, when the choice can be taken of the sample dipped in the lime or the original color.

RED.—Take muriate of tin, $\frac{1}{2}$ of a tea-cup; add sufficient water to cover the goods well, bring it to a boiling heat, putting in the goods 1 hour, stirring often; take out the goods, and empty the kettle, and put in clean water, with nicewood, 1 lb., steeping it for $\frac{1}{2}$ hour, at hand heat; then put in the goods, and increase the heat for 1 hour, not bringing to a boil at all, stir the goods, and dip an hour as before; wash without soap.

MURIATE OF TIN.—TIN LIQUOR.—If druggists keep it, it is best to purchase of them already made; but if you prefer, proceed as follows: Get at a tinner's shop, block tin; put it in a shovel, and melt it. After it is melted, pour it from the height of 4 or 5 feet into a pail of clear water. The object of this is to have the tin in small particles, so that the acid can dissolve it. Take it out of the water and dry it; then put it into a strong glass bottle; pour over it muriatic acid, 12 oz.; then slowly add sulphuric acid, 8 oz. The acid should be added about a tablespoon at a time, at intervals of 5 or 8 minutes; for if you add it too rapidly you run the risk of breaking the bottle by heat. After you have all the acid

in, let the bottle stand until the ebullition subsides; then stop it up with a bees'-wax or glass stopper, and set it away; and it will keep good for a year or more, or will be fit for use in 24 hours.

GREEN.—VERY HANDSOME WITH OAK BARK.—For 1 lb. of silk, yellow oak bark, 8 oz.; boil it $\frac{1}{2}$ hour; turn off the liquor from the bark, and add alum, 6 oz.; let stand until cold; while this dye is being made, color the goods in the blue dye-tub, a light blue; dry, and wash; then dip in the alum and bark dye; if it does not take well, warm the dye a little.

GREEN OR YELLOW.—ON SILK OR WOOL, IN FIVE TO FIFTEEN MINUTES.—For 5 lbs. of goods, black oak bark or peach leaves, $\frac{1}{2}$ peck; boil well; then take out the bark or leaves, and add muriate of tin, $\frac{1}{2}$ teacup, stirring well; then put in the goods and stir them round, and it will dye a deep yellow in from 5 to 15 minutes, according to the strength of the bark; take out the goods, rinse, and dry immediately.

N.B.—For a green, add to the above dye extract of indigo, or chemic, 1 tablespoon only at a time, and work the goods 5 minutes, and air; if not sufficiently dark, use the same amount of chemic as before, and work again until it suits.

MULBERRY.—For 1 lb. of silk, alum, 4 oz.; dip 1 hour; wash out, and make a dye with Brazil wood, 1 oz.; and logwood, $\frac{1}{4}$ oz.; by boiling together; dip in this $\frac{1}{2}$ hour, then add more Brazil wood and logwood, in equal proportions, until the color is dark enough.

BLACK.—Make a weak dye as you would for black on woollens, work the goods in bichromate of potash, at a little below boiling heat, then dip in the logwood in the same way; if colored in the blue vitriol dye, use about the same heat.

SPOTS.—TO REMOVE AND PREVENT WHEN COLORING BLACK ON SILK OR WOOLLEN.—**N.B.** In dyeing silk or woollen goods, if they should become rusty or spotted, all that is necessary is to make a weak lye, and have it scalding hot, and put your goods in for 15 minutes; or throw some ashes into your dye, and run your goods in it 5 minutes, and they will come out a jet black, and an even color.

LIGHT CHEMIC BLUE.—For cold water, 1 gal.; dissolve alum, $\frac{1}{2}$ tablespoon, in hot water, 1 teacup, and add to it; then add chemic, 1 teaspoon at a time, to obtain the desired color; the more chemic that is used, the darker will be the color.

PURPLE.—For 1 lb. of silk: having first obtained a light blue by dipping in the home-made blue dye-tub, and dried, dip in alum, 4 oz.; to sufficient water to cover, when a little warm; if the color is not full enough, add a little chemic.

YELLOW.—For 1 lb. of silk, alum, 3 oz.; sugar of lead, $\frac{3}{4}$ oz.; immerse the goods in the solution over night; take out, drain, and make a new dye with fustic, 1 lb.: dip until the required color is obtained.

N.B.—The yellow or green, for wool, works equally well on silk.

ORANGE.—Take annotto and soda, and add in equal quantities, according to the amount of goods and darkness of the color wanted, say 1 oz. of each, to each pound of silk, and repeat as desired.

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CRIMSON.—For 1 lb. of silk, alum, 3 oz. ; dip at hand-heat, 1 hour ; take out and drain, while making a new dye, by boiling, 10 minutes, cochineal, 3 oz. ; bruised nut-galls, 2 oz. ; and cream of tartar, $\frac{1}{4}$ oz., in one pail of water ; when a little cool, begin to dip, raising the heat to a boil, continuing to dip 1 hour ; wash, and dry.

CINNAMON OR BROWN ON COTTON AND SILK—BY A NEW PROCESS—**VERY BEAUTIFUL.**—Give the goods as much color, from a solution of blue vitriol, 2 oz., to water, one gal., as it will take up in dipping 15 minutes ; then run it through lime-water ; this will make a beautiful sky-blue, of much durability ; it has now to be run through a solution of prussiate of potash, 1 oz., to water, 1 gal.

ANILINE BLACK ON SILK OR COTTON.—Water, 20 to 30 parts ; chlorate of potassa, 1 part ; sal ammoniac, 1 part ; chloride of copper, 1 part ; aniline, 1 part ; and hydrochloric, 1 part ; previously mixed together. The fabric or yarn is dried in ageing rooms at a low temperature for 24 hours and washed afterwards.

TO COLOR STRAW HATS OR BONNETS A BEAUTIFUL SLATE.—First, soak the bonnet in rather strong warm suds for 15 minutes to remove sizing or stiffening ; then rinse in warm water, to get out the soap ; now scald cudbear, 1 oz., in sufficient water to cover the hat or bonnet ; work the bonnet in this dye, at 180° of heat, until you get a light purple ; now have a bucket of cold water, blued with the extract of indigo, $\frac{1}{4}$ oz., and work or stir the bonnet in this, until the tint pleases ; dry, then rinse out with cold water, and dry again in the shade. If you get the purple too deep in shade the final slate will be too dark.

TO BLEACH STRAW BONNETS.—Take a common plate, fill it with water, set a small piece of sheet iron, with the ends bent down to raise the top above the water, place in the middle of the tin plate, on which you must place a small piece of brimstone, set it on fire, and cover it over tight with a large bell or large tumbler or bowl that will just shut down close within the rim of the plate ; at first raise the cover a little to admit a current of air to cause the sulphur to burn, until you fill the whole with a white vapor ; then shut down tight about ten minutes, and the water will absorb the sulphurous acid gas, with which straw hats or wooden articles are washed over to bleach in the most approved manner. It will also remove fruit and vegetable stains from dress.

WASHING FLUID.—Take 1 lb. sal soda, $\frac{1}{2}$ lb. good stone lime, and 5 qts. of water ; boil a short time, let it settle, and pour off the clear fluid into a stone jug, and cork for use ; soak your white clothes over night in simple water, wring out and soap wristbands, collars, and dirty or stained places ; have your boiler half filled with water just beginning to boil, then put in one common teacupful of fluid, stir and put in your clothes, and boil for half an hour, then rub lightly through *one suds only*, and all is complete.

CHIP OR STRAW HATS OR BONNETS may be dyed black by boiling them three or four hours in a strong liquor of logwood, adding a little copperas occasionally. Let the bonnets remain in the liquor all night ; then take out to dry in the air. If the black is not satisfactory, dye again after drying. Rub inside and out with a sponge moistened in fine oil ; then black. *Red Dye.*—Boil ground Brazil-

wood in a lye of potash, and boil your straw hats, &c., in it. *Blue Dye*.—Take a sufficient quantity of potash lye, 1 lb. of litmus or lacmus, ground: make a decoction and then put in the straw, and boil it.

DYES FOR HATS.—The ordinary bath for dyeing hats, employed by the London manufacturers, consists, for twelve dozen, of 144 lbs. logwood; 12 lbs. of green sulphate of iron or copperas; $7\frac{1}{2}$ lbs. verdigris. The logwood having been introduced into the copper, and digested for some time, the copperas and verdigris are added in successive quantities, and in the above proportions, along with every successive two or three dozens of hats suspended upon the dripping machine. Each set of hats, after being exposed to the bath with occasional airings during forty minutes, is taken off the pegs, and laid out upon the ground to be more completely blackened by the peroxydization of the iron with the atmospheric oxygen. In three or four hours, the dyeing is completed. When fully dyed, the hats are well washed in running water.

WATERPROOF STIFFENING FOR HATS.—Mix 18 lbs. of shellac with $\frac{1}{2}$ lb. of salt of tartar (carbonate of potash), and $5\frac{1}{2}$ gals. water. These materials are to be put in a kettle, and made to boil gradually till the lac is dissolved, when the liquid will become as clear as water, without any scum upon the top, and if left to cool, will have a thin crust upon the surface, of a whitish cast, mixed with the light impurities of the gum. When this skin is taken off, the hat body is to be dipped into the mixture in a cold state, so as to absorb as much as possible of it; or it may be applied with a brush or sponge. The hat body, being thus stiffened, may stand till it becomes dry, or nearly so; and after it has been brushed, it must be immersed in very dilute sulphuric or acetic acid, in order to neutralize the potash, and cause the shellac to set. If the hats are not to be napped immediately, they may be thrown into a cistern of pure water, and taken out as wanted.

METHOD OF BLEACHING STRAW.—Dip the straw in a solution of oxygenated muriatic acid, saturated with potash. (Oxygenated muriate of lime is much cheaper.) The straw is thus rendered very white, and its flexibility is increased.

BLEACHING STRAW GOODS.—Straw is bleached by simply exposing it in a closed chamber to the fumes of burning sulphur, an old flour barrel is the apparatus most used for the purpose by milliners, a flat stone being laid on the ground, the sulphur ignited thereon, and the barrel containing the goods to be bleached turned over it. The goods should be previously washed in pure water.

VARNISH FOR FADED RUBBER GOODS.—Black Japan varnish diluted with a little linseed oil.

TO BLEACH LINEN.—Mix common bleaching-powder, in the proportion of 1 lb. to a gallon of water; stir it occasionally for three days, let it settle, and pour it off clear. Then make a lye of 1 lb. of soda to 1 gallon of boiling soft water, in which soak the linen for 12 hours, and boil it half an hour; next soak it in the bleaching liquor, made as above; and lastly, wash it in the usual manner.

Discolored linen or muslin may be restored by putting a portion of bleaching liquor into the tub wherein the articles are soaking.

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ANILINE GREEN ON SILK.—Iodine green or night green dissolves easily in warm water. For a liquid dye, 1 lb. may be dissolved in 1 gal. alcohol, and mixed with 2 gals. water, containing 1 oz. sulphuric acid.

TO DYE ANILINE SCARLET.—For every 40 lbs. of goods, dissolve 5 lbs. white vitriol (sulphate of zinc) at 180° Fah., place the goods into this bath for 10 minutes, then add the color, prepared by boiling for a few minutes, 1 lb. aniline scarlet in 3 gals. water, stirring the same continually. This solution has to be filtered before being added to the bath. The goods remain in the latter for 15 minutes, when they have become browned and must be boiled for another half hour in the same bath after the addition of sal ammoniac. The more of this is added the deeper will be the shade.

BISMARCK BROWN FOR DYEING.—Mix together 1 lb. Bismarck, 5 gals. water, and $\frac{3}{4}$ lb. sulphuric acid. This paste dissolves easily in hot water and may be used directly for dyeing. A liquid dye may be prepared by making the bulk of the above mixture to 2 gals. with alcohol. To dye with the above mixture, sour with sulphuric acid; add a quantity of sulphate of soda, immerse the wool, and add the color by small portions, keeping the temperature under 212° Fah. Very interesting shades may be developed by combining the color with indigo paste or picric acid.

TO DYE WOOL WITH ANILINE GREEN.—For wool, prepare two baths, one containing the dissolved dye and a quantity of carbonate of soda or borax. In this the wool is placed, and the temperature is raised to 212° Fah. A greyish green is produced, which must be brightened and fixed in a second bath of water 100° Fah., to which some acetic acid has been added. Cotton requires preparation by sumach.

ANILINE BLUE.—To 100 lbs. of fabric dissolve $1\frac{1}{4}$ lbs. aniline blue in 3 qts. hot alcohol; strain through a filter and add it to a bath of 130° Fah.; also 10 lbs. glauber salts, and 5 lbs. acetic acid. Enter the goods and handle them well for 20 minutes; next heat it slowly to 200° Fah.; then add 5 lbs. sulphuric acid diluted with water. Let the whole boil 20 minutes longer, then rinse and dye. If the aniline be added in two or three proportions during the process of coloring, it will facilitate the evenness of the color.

ANILINE RED.—Enclose the aniline in a small muslin bag, have a kettle (tin or brass) filled with moderately hot water and rub the substance out. Then immerse the goods to be colored, and in a short time they are done. It improves the color to wring the goods out of strong soap suds before putting them in the dye. This is a permanent color on wool or silk.

ANILINE VIOLET AND PURPLE.—Acidulate the bath by sulphuric acid, or use sulphate of soda; both these substances render the shade bluish. Dye at 212° Fah. To give a fair middle shade to 10 lbs. of wool, a quantity of solution equal to $\frac{1}{2}$ to $\frac{3}{4}$ ozs. of the solid dye will be required. The color of the dyed fabric is improved by washing in soap and water, and then passing through a bath soured by sulphuric acid.

ANILINE BLACK FOR DYEING.—Water 20 to 30 parts, chlorate of potassa 1 part; sal ammoniac 1 part; chloride of copper 1 part; aniline hydrochloric acid, of each 1 part, previously mixed together.

It is essential that the preparation should be acid, and the more acid it is the more rapid will be the production of the blacks; if too much so, it may injure the fabric.

NEW MORDANT FOR ANILINE COLORS.—Immerse the goods for some hours in a bath of cold water in which chloride or acetate of zinc has been dissolved until the solution shows 2° Baumé; for the wool the mordanting bath should be at a boiling heat, and the goods should also be placed in a warm bath of tannin 90° Fah., for half an hour. In dyeing, a hot solution of the color must be used to which should be added, in the case of the cotton, some chloride of zinc, and, in the case of the wool, a certain amount of tannin solution.

TO DYE SILK OR WOOL MAGENTA.—Sufficient water to cover, without difficulty, the fabric to be dyed, is brought to a temperature of about 170° Fah.; a sufficient quantity of the dye is added, and followed by the immersion of the goods, which should be moved about to prevent streaks. About half an hour's immersion is sufficient. Half an ounce of the crystals should give a fair shade to 10 lbs. of wool.

TO DYE ANILINE YELLOW.—This color is slightly soluble in water, and for dyer's use may be used directly for the preparation of the bath dye, but is best used by dissolving 1 lb. of dye in 2 gals. alcohol. Temperature of bath should be under 200° Fah. The color is much improved and brightened by a trace of sulphuric acid.

TO DYE WITH ALKALI BLUE AND NICHOLSON'S BLUE.—Dissolve 1 lb. of the dye in 10 gals. boiling water, add this by small portions to the dye bath, which should be rendered alkaline by borax. The fabric should be well worked about between each addition of the color. The temperature must be kept under 212° Fahr. To develop the color wash with water and pass through a bath containing sulphuric acid.

ANILINE BROWN DYE.—Dissolve 1 lb. of the brown in 2 gals. of spirit, specific gravity 8200, add a sufficient quantity to the dye bath, and immerse the fabric. Wool possesses a very strong affinity for this color and no mordant is required.

TO EXTRACT OIL SPOTS FROM FINISHED GOODS.—Saturate the spot with benzine, then place two pieces of very soft blotting paper under and two upon it, press well with a hot iron, and the grease will be absorbed.

TO PRESERVE GOODS AND CLOTHING FROM MILDEW.—Alum, 2 lbs., dissolved in 60 lbs. water, blue vitriol, 2 lbs., dissolved in 8 lbs. of water, to which is added gelatine 1 lb., dissolved in 30 lbs. of water, acetate of lead, $\frac{1}{2}$ lb. dissolved in 30 lbs. of water. The solutions are all hot, and separately mixed, with the exception of the vitriol which is added.

TO BLEACH FEATHERS.—Place the feathers from 3 to 4 hours in a tepid dilute solution of bichromate of potassa, to which, cautiously, some nitric acid has been added, (a small quantity only). To remove a greenish hue induced by this solution, place them in a dilute solution of sulphurous acid, in water, whereby the feathers become perfectly white and bleached.

TO CLEAN STRAW BONNETS.—First brush them with soap and water, then with a solution of oxalic acid.

BLACK VARNISH FOR CHIP AND STRAW HATS.—Best alcohol, 4 oz.; pulverized black sealing-wax, 1 oz.; put them into a phial, and put the phial into a warm place, stirring or shaking occasionally until the wax is dissolved. Apply it when warm before the fire or in the sun. This makes a beautiful gloss.

EASY METHOD OF PREVENTING MOTHS IN FURS OR WOOLLENS.—Sprinkle the furs or woollen stuffs, as well as the drawers or boxes in which they are kept, with spirits of turpentine, the unpleasant scent of which will speedily evaporate on exposure of the stuffs to the air. Some persons place sheets of paper, moistened with spirits of turpentine, over, under, or between pieces of cloth, &c., and find it a very effectual method. Many woollen drapers put bits of camphor, the size of a nutmeg, in papers, on different parts of the shelves in their shops, and as they brush their cloths every two, three or four months, this keeps them free from moths: and this should be done in boxes where furs, &c., are put. A tallow candle is frequently put within each muff when laid by.

CLOTHING RENOVATOR.—Soft water, 1 gal.; make a strong decoction of logwood by boiling the extract with the water. Strain, when cool, add 2 oz. gum arabic in powder; bottle, cork well, and set aside for use; clean the coat well from grease and dirt, and apply the above liquid with a sponge evenly. Dilute to suit the color, and hang in the shade to dry; afterwards brush the nap smooth, and it will look like new.

WATERPROOFING FOR POROUS CLOTH.—Dissolve $2\frac{1}{2}$ lbs. alum in 4 gals. water; dissolve also in a separate vessel the same weight of acetate of lead in the same quantity of water. When both are well dissolved, mix the solutions together; and, when the sulphate of lead resulting from this mixture has been precipitated to the bottom of the vessel in the form of a powder, pour off the solution, and plunge into it the fabric to be rendered waterproof. Wash and rub it well during a few minutes, and hang it in the air to dry.

TO REMOVE GREASE.—Aqua ammonia, 2 oz.; soft water, 1 quart; saltpetre, 1 teaspoonful; shaving soap in shavings, 1 oz.; mix altogether; dissolve the soap well, and any grease or dirt that cannot be removed with this preparation, nothing else need be tried for it.

WATERPROOFING FOR CLOTHING.—Boiled oil, 15 lbs.; bee's-wax, 1 lb.; ground litharge, 13 lbs.; mix, and apply with a brush to the article, previously stretched against a wall or a table, previously well washing and drying each article before applying the composition.

TO RENEW OLD SILKS.—Unravel and put them in a tub, cover them with cold water, let them remain one hour; dip them up and down, but do not wring; hang up to drain, and iron while very damp, and they will look beautiful.

DYES FOR FURS.—For black, use the hair dye described in these receipts. *Brown*, use tincture of logwood. *Red*, ground Brazil-wood $\frac{1}{4}$ lb.; water, $1\frac{1}{2}$ quarts; cochineal, $\frac{1}{2}$ oz.; boil the Brazil-wood in the water one hour; strain and add the cochineal; boil fifteen minutes. *Scarlet color*, boil $\frac{1}{2}$ oz. saffron in $\frac{1}{2}$ pint of water, and pass over the work before applying the red. *Blue*, logwood, 7 oz.; blue vitriol, 1 oz.; water, 22 oz.; boil. *Purple*, logwood, 11 oz.; alum, 5 oz.; water, 29 oz. *Green*, strong vinegar, $1\frac{1}{2}$ pints; best

verdigris, 2 oz.; ground fine; sap green, $\frac{1}{2}$ oz.; mix all together and boil.

POTTER'S INVISIBLE WATERPROOFING FOR CLOTHING.—Imbue the cloth on the wrong side with a solution of isinglass, alum, and soap dissolved in water, forming an emulsion of a milky thickness; apply with a brush, rubbing in well. When dry, it is brushed on the wrong side against the grain, and then gone over with a brush dipped in water; afterwards brushed down smooth.

TO RAISE A NAP ON CLOTH.—Clean the article well; soak it in cold water for half an hour; put it on a board, and rub the thread-bare parts with a half-worn hatter's card filled with flocks, or with a teazle or a prickly thistle until a nap is raised; then lay the nap the right way with a hatter's brush, and hang up to dry.

BLACK REVIVER FOR CLOTH.—Bruised galls, 1 lb.; logwood, 2 lbs.; green vitriol, $\frac{1}{2}$ lb.; water, 5 quarts; boil two hours; strain, and it is ready for use.

DRUGGISTS' DEPARTMENT.

REMEDY FOR DIPHTHERIA.—The treatment consists in thoroughly swabbing the back of the mouth and throat with a wash made thus: Table salt, 2 drams; black pepper, golden seal, nitrate of potash, alum, 1 dram each; mix and pulverize; put into a teacup half full of water; stir well, and then fill up with good vinegar. Use every half hour, one, two, and four hours, as recovery progresses. The patient may swallow a little each time. Apply 1 oz. each of spirits turpentine, sweet oil, and aqua-ammonia, mixed, every hour to the whole of the throat, and to the breast bone every four hours, keeping flannel to the part.

HOLLOWAY'S OINTMENT AND PILLS.—Butter, 22 oz.; beeswax, 3 oz.; yellow rosin, 3 oz.; melt; and vinegar of cantharides, 1 oz. evaporate; and add Canada balsam, 1 oz.; oil of mace, $\frac{1}{2}$ dram; balsam of Peru, 15 drops. *Pills*: Aloes, 4 parts; myrrh, jalap, and ginger, of each 2 parts; mucilage to mix.

ABERNETHY'S PILLS.—Each pill contains 2 grains of blue pill and 3 grains compound extract of colocynth.

WORM LOZENGES.—Powdered lump sugar, 10 oz.; starch, 5 oz.; mix with mucilage; and to every ounce add 12 grains calomel; divide in 20 grain lozenges. Dose, two to six.

SOOTHING SYRUP.—Alcoholless of peppermint, castor oil, of each, 1 oz.; mix; add oil of anise, $\frac{1}{2}$ dram; magnesia, 60 grains; pulverized ginger, 40 grains; water, 2 oz.; white sugar to form a syrup.

SOOTHING SYRUP.—Take 1 lb. of honey; add 2 tablespoonfuls of paregoric, and the same of oil of anise seed; add enough water to make a thick syrup, and bottle. For children teething, dose, teaspoonful occasionally.

INFANT'S SYRUP.—The syrup is made thus; 1 lb. best box raisins; $\frac{1}{2}$ ounce of anise seed; two sticks licorice; split the raisins, pound the anise seed, and cut the licorice fine; add to it 3 quarts of rain water, and boil down to 2 quarts. Feed three or four times a day, as much as the child will willingly drink. The raisins are to

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strengthen; the anise is to expel the wind, and the licorice as a physic.

BRANDETH'S PILLS.—Take 2 lbs. of aloes, 1 lb. of gamboge, 4 oz. of extract of colocynth, $\frac{1}{2}$ lb. of Castile soap, 3 fluid drams of oil of peppermint, and 1 fluid dram of cinnamon. Mix, and form into pills.

PERRY DAVIS' PAIN KILLER.—Myrrh, $1\frac{1}{2}$ oz.; guaiacum resin, 1 oz.; camphor, $\frac{1}{2}$ oz.; red pepper, oil anise, each, 1 dram; dilute alcohol, 2 pints; mix. Stand seven days, and filter.

FAHNESTOCK'S VERMIFUGE.—Castor oil, oil of worm seed, each 1 oz.; oil anise, $\frac{1}{2}$ oz.; tincture myrrh, $\frac{1}{2}$ dram; oil turpentine, 10 minims; castor oil, 2 drops; mix.

SWAIM'S VERMIFUGE.—Wormseed, 2 oz.; valerian, rhubarb, pink-root, white agaric, of each $1\frac{1}{2}$ oz.; boil in sufficient water to yield 3 quarts of decoction; and add to it 10 drops of oil of tansy and 45 drops of oil of cloves, dissolved in a quart of rectified spirits. Dose, 1 tablespoonful at night.

AYER'S CHERRY PECTORAL.—Take 4 grains of acetate of morphia; 2 fluid drams of tincture of bloodroot; 3 fluid drams each of antimonial wine and wine of ipecacuanha, and 3 fluid oz. of syrup of wild cherry. Mix.

BROWN'S BRONCHIAL TROCHES.—Take 1 lb. of pulverized extract of licorice; $1\frac{1}{2}$ lb. of pulverized sugar; 4 oz. of pulverized cubeba; 4 oz. of pulverized gum arabic, 1 oz. of pulverized extract of conium. Mix.

RUSSIA SALVE.—Take equal parts of yellow wax and sweet oil; melt slowly, carefully stirring; when cooling, stir in a small quantity of glycerine. Good for all kinds of wounds, &c.

DENTIST'S COMPOSITION FOR FILLING DECAYED TEETH.—Gold, 1 part; mercury, 8 parts; incorporated by heating together; when mixed pour them into cold water. Or, tinfoil and quicksilver; melt together in a convenient vessel, take a small quantity, knead it in the palm of the hand, and apply quick. Or, mix a little finely-powdered glass with some mineral succedaneum; apply as usual. Or, take some mineral succedaneum, and add some steel dust. Or, mineral succedaneum mixed with levigated porcelain or china. Or, gypsum, 1 part; levigated porcelain, 1 part; levigated iron filings, 1 part; make into a paste with equal parts of quick drying copal and mastic varnish. Or, quicksilver, 40 grains; steel filings, 26 grains. Or, silver, 72 parts; tin, 20 parts; zinc, 6 parts. Better than any, pure gold, 1 part; silver, 3 parts; tin, 2 parts; melt the first two, add the tin, reduce all to a fine powder, use with an equal quantity of pure mercury.

Gutta-serena, softened by heat, is recommended. Dr. Rolfs advises melting a piece of caoutchouc at the end of a wire, and introducing it while warm.

Amalgams for the teeth are made with gold or silver, and quicksilver, the excess of the latter being squeezed out, and the stiff amalgam used warm. Inferior kinds are made with quicksilver and tin, or zinc. A popular nostrum of this kind consists of 40 grains of quicksilver and 20 of fine zinc filings, mixed at the time of using. The following is said to be the most lasting and least objectionable amalgam: Melt 2 parts of tin with 1 of cadmium,

run it into an ingot, and reduce it to filings. Form these into a fluid amalgam with mercury, and squeeze out the excess of mercury through leather. Work up the solid residue in the hand, and press it into the tooth. Another cement consists of about 73 parts of silver, 21 of tin, and 6 of zinc, amalgamated with quick-silver.

POUDRE METALLIQUE.—The article sold under this name in Paris appears to be an amalgam of silver, mercury, and ammonium, with an excess of mercury, which is pressed out before using it.

TO EXTRACT TEETH WITH LITTLE OR NO PAIN.—Tincture of acetonite, chloroform, and alcohol, of each 1 oz.; mix; moisten two pledgets of cotton with the liquid, and apply to the gums on each side of the tooth to be extracted, holding them in their place with pliers or other instruments for from five to ten minutes, rubbing the gum freely inside and out.

TOOTH WASH.—To REMOVE BLACKNESS.—Pure muriatic acid, 1 oz.; water, 1 oz.; honey, 2 oz.; mix. Take a tooth-brush, and wet it freely with this preparation, and briskly rub the black teeth, and in a moment's time they will be perfectly white; then immediately wash out the mouth with water, that the acid may not act upon the *enamel* of the teeth.

DENTIST'S NERVE PASTE.—Arsenic, 1 part; rose pink, 2 parts. To destroy the nerve, apply this preparation on a pledget of cotton, previously moistened with creosote, to the cavity of the tooth, let it remain 4 hours, then wash out thoroughly with water.

DENTIST'S EMERY WHEELS.—Emery, 4 lbs.; shellac, $\frac{1}{2}$ lb.; melt the shellac over a slow fire; stir in the emery, and pour into a mould of plaster of Paris. When cold it is ready for use.

BASE FOR ARTIFICIAL TEETH.—PROPORTIONS.—India rubber, 1 lb.; sulphur, $\frac{1}{2}$ lb.; vermilion, 1 lb. 4 oz.

CURE FOR LOCK JAW, SAID TO BE POSITIVE.—Let any one who has an attack of lock jaw take a small quantity of spirits of turpentine, warm it, and pour it on the wound—no matter where the wound is, or what its nature is, and relief will follow in less than one minute. Turpentine is also a sovereign remedy for croup. Saturate a piece of flannel with it, and place the flannel on the throat and chest—and in very severe cases three to five drops on a lump of sugar may be taken internally.

COMPOUND EXTRACT OF BUCHU.—Buchu leaves, 1 lb.; boiling distilled water, 3 gals.; boil the leaves in 2 gals. of the water down to 6 qts.; then boil it again in the remaining water till reduced to 2 qts. Evaporate the mixed liquors down to 6 qts., and add 1 qt. strong sage tea, 2 drs. bicarb. potassa, 2 drs. tinct. cannabis indica, 5 oz. rectified spirit, 2 oz. balsam copaiba, and Harlem oil, 1 bottle.

NEW METHOD OF EMBALMING.—Mix together 5 pounds dry sulphate of alumine, 1 quart of warm water, and 100 grains of arsenious acid. Inject 3 or 4 quarts of this mixture into all the vessels of the human body. This applies as well to all animals, birds, fishes, &c. This process supersedes the old and revolting mode, and has been introduced into the great anatomical schools of Paris.

NITRATE OF SILVER.—Pure silver, $1\frac{1}{2}$ oz.; nitric acid, 1 oz. diluted with water, 2 oz.; heat by a sand-bath until ebullition ceases, and

the water is expelled then pour into moulds. This substance must be kept from the light.

HAIR DYE, No. 1.—Take gallic acid, $\frac{1}{2}$ oz.; alcohol, 8 oz.; soft water, 16 oz. Put the acid in the alcohol, then add the water.

No. 2.—Crystallized nitrate of silver, 1 oz.; strongest ammonia, 3 oz.; gum arabic, $\frac{1}{2}$ oz.; soft water, 6 oz. Put the silver in the ammonia; do not cork it till it is dissolved; dissolve the gum in the water, then mix, and it is ready for use.

Keep Nos. 1 and 2 in separate bottles, and apply each alternately to the hair. Be particular to cleanse the hair before applying the dye.

ANOTHER.—Nitrate of silver, 11 drams; nitric acid, 1 dram; distilled water, 1 pint; sap green, 3 drams; gum arabic, 1 dram. Mix.

ANOTHER.—Nitric acid, 1 dram; nitrate of silver, 10 drams; sap green, 9 drams; mucilage, 5 drams; distilled water, $37\frac{1}{2}$ fluid oz.

HAIR INVIGORATOR.—Bay rum, 2 pints; alcohol, 1 pint; castor oil, 1 oz.; carb. ammonia, $\frac{1}{2}$ oz.; tincture of cantharides, 1 oz. Mix them well. This compound will promote the growth of the hair, and prevent it from falling out.

RAZOR-STROP PASTE.—Wet the strop with a little sweet oil, and apply a little flour of emery evenly over the surface.

OIL OF ROSES.—Olive oil, 1 lb.; otto of roses, 50 drops; oil of rosemary, 25 drops; mix. Another, roses (hardly opened) 12 oz.; olive oil, 10 oz., beat them together in a mortar; let them remain for a few days, then express the oil.

BALEM OF BEAUTY.—Pure soft water, 1 qt.; pulverized Castile soap, 4 oz.; emulsion of bitter almonds, 6 oz.; rose and orange flower water, of each, 8 oz.; tincture of benzoin, 2 drs.; borax, 1 dr.; add 5 grs. bichloride of mercury to every 8 oz. of the mixture. To use, apply on a cotton or linen cloth to the face, &c.

ORIENTAL COLD CREAM.—Oil of almonds, 4 oz., white wax and spermaceti, of each, 2 drs.; melt, and add rose water, 4 oz.; orange flower water, 1 oz.; used to soften the skin, apply as the last.

SHAVING CREAM.—White wax, spermaceti, and almond oil, of each $\frac{1}{2}$ oz.; melt, and while warm, beat in 2 squares of Windsor soap previously reduced to a paste with rose water.

CIRCASSIAN CREAM.—Take 2 ounces of perfectly fresh suet, either mutton or venison; 3 ounces of olive oil; 1 oz. gum benzoin in powder, and $\frac{1}{2}$ oz. of alkanet root. Put the whole into a jam jar, which, if without a lid, must be tied over with bladder, and place the jar in a saucepan containing boiling water, at the side of the fire. Digest for a whole day, then strain away all that is fluid through fine muslin, and stir till nearly cold. Add, say 1 dram of essence of almonds, roses, bergamot or any other perfume desired.

FRECKLE CURE.—Take two oz. lemon juice, or half a dram of powdered borax, and one dram of sugar; mix together, and let them stand in a glass bottle for a few days, then rub on the face occasionally.

YANKEE SHAVING SOAP.—Take 3 lbs. white bar soap, 1 lb. Castile soap, 1 quart rain water, $\frac{1}{2}$ pt. beef's gall, 1 gill spirits of turpen-

time. Cut the soap into thin slices, and boil five minutes after the soap is dissolved, stir while boiling: scent with oil of rose or almonds. If wished to color it, use $\frac{1}{2}$ oz. vermilion.

BLOOM OF YOUTH.—Boil 1 ounce of Brazil wood in 3 pints of water for 15 minutes; strain. Add $\frac{3}{4}$ oz. isinglass, $\frac{1}{4}$ oz. cochineal, 1 oz. alum, $\frac{1}{2}$ oz. borax. Dissolve by heat, and strain.

COLOGNE WATER.—Oils of rosemary and lemon, of each $\frac{1}{4}$ oz.; oils of bergamot and lavender, each $\frac{1}{4}$ oz.; oil cinnamon, 8 drops; oils of cloves and rose, each 15 drops; best deodorized alcohol, 2 qts.; shake 2 or 3 times per day for a week.

We propose to give the formula for the following preparations, and shall commence with what is said to be

BOGLE'S HYPERION FLUID.—To 8 oz. of 90 or 95 per cent. alcohol, colored red with alkanet, add 1 oz. of castor-oil: perfume with geranium and verberna.

LYON'S KATHAIRON.—To 8 oz. of 80 per cent. alcohol, colored yellow by a few drops extract of annatto, add 2 oz. castor-oil, and perfume with a little bergamot.

PHALON'S HAIR RESTORATIVE.—To 8 oz. of 90 per cent. alcohol, colored by a few drops tincture of alkanet root, add 1 oz. of castor oil, and perfume with a compound of bergamot, neroli, verberna, and orange.

MRS. ALLEN'S.—To 16 oz. of rose water, diluted with an equal part of salt water, add $\frac{1}{2}$ oz. of sulphur and $\frac{1}{4}$ oz. of sugar of lead; let the compound stand five days before using.

BACHELOR'S HAIR-DYE.—No. 1. To 1 oz. of gallic acid, dissolved in 8 oz. alcohol, add $\frac{1}{2}$ gal. soft water. No. 2. To 1 oz. nitrate of silver, dissolved in 1 oz. of concentrated ammonia, and 3 oz. of soft water, add 1 oz. gum arabic and 4 oz. of soft water.

CHRISTADORO'S HAIR-DYE.—No. 1. To $\frac{1}{4}$ oz. of gallic acid, dissolved in 8 oz. alcohol, add $\frac{1}{2}$ gal. soft water. No. 2. To 1 oz. crystallized nitrate of silver, dissolved in 1 oz. concentrated aqua-ammonia and 2 oz. soft water, add 2 oz. gum arabic and 5 oz. soft water.

PHALON'S INSTANTANEOUS HAIR-DYE.—No. 1. To $1\frac{1}{2}$ oz. gallic acid, and $\frac{1}{4}$ oz. of tannia, dissolved in 8 oz. of alcohol, add $\frac{1}{2}$ gal. of soft water. No. 2. To 1 oz. crystallized nitrate of silver, dissolved in 1 oz. concentrated aqua-ammonia, add $1\frac{1}{2}$ oz. gum arabic, and 8 oz. soft water.

HARRISON'S.—No. 1. To $\frac{1}{2}$ oz. gallic acid, 1 oz. of tannia dissolved in 10 oz. alcohol, add 2 qts. soft water. No. 2. To 1 oz. crystallized nitrate of silver, dissolved in 2 oz. of concentrated aqua-ammonia, add 12 oz. soft water and $1\frac{1}{2}$ oz. gum arabic. No. 3. 1 oz. hydro-sulphate of potassa, dissolved in $\frac{1}{2}$ gal. of soft water. This last ingredient is intended to produce a deep black color if the others should fail.

PHALON'S (ONE PREPARATION.)—To 1 oz. crystallized nitrate of silver, dissolved in 2 oz. of aqua-ammonia, add 16 oz. soft water. This is not an instantaneous dye; but, after exposure to the light and air, a dark color is produced upon the surface to which it is applied.

PROFESSOR WOOD'S.—To 8 oz. vinegar, diluted with an equal part of soft water, add 2 drs. sulphur, and 2 drs. sugar of lead.

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EXTRACT OF PATCHOULI.—Mix $1\frac{1}{2}$ ozs. ottar of Patchouli, and $\frac{1}{2}$ oz. ottar of rose, with 1 gal. rectified spirits.

SEA FOAM FOR BARBERS.—Alcohol, 4 oz.; castor oil, 1 oz.; ammonia, $\frac{1}{2}$ oz.; water, 1 pt. Dissolve the castor oil and ammonia in the alcohol, then add the alcohol mixture to the water.

PYROGALLIC HAIR DYE.—Pyrogallie acid, $\frac{1}{2}$ oz. dissolve it in hot distilled water $1\frac{1}{2}$ oz., when the solution cools add gradually rectified spirit, $\frac{1}{2}$ fluid oz.

FINE SHAMPOO LIQUID.—Dissolve $\frac{1}{2}$ oz. carb. of ammonia and 1 oz. of borax in 1 qt. water, then add 2 oz. glycerine, 3 qts. of New England rum, and 1 qt. of bay rum, moisten the hair with this liquor, shampoo with the hands until a slight lather is formed, then wash off with clean water.

CHEAP BAY RUM.—Saturate a $\frac{1}{2}$ lb. block of carb. of magnesia with oil of Bay; pulverize the magnesia, place it in a filter and pour water through it until the desired quantity is obtained, then add alcohol. The quantity of water and alcohol employed depends on the desired strength and quantity of the Bay rum. *Another*, Oil of Bay, 10 fluid drs.; oil of pimento, 1 fluid dr.; acetic ether, 2 fluid drs.; alcohol 3 gals.; water $2\frac{1}{2}$ gals. Mix, and after 2 weeks repose filter.

LIQUID FOR FORCING THE BEARD.—Cologne 2 oz.; liquid hartshorn, 1 dr.; tinct. cantharides, 2 drs.; oil rosemary, 12 drops; lavender, 12 drops. Apply to the face daily and await results. Said to be reliable.

COURT PLASTER.—Brush silk over with a solution of isinglass, in spirit or warm water, dry and repeat several times. For the last application apply several coats of balsam of Peru. Used to close cuts or wounds, by warming it, and applying. It does not wash off until the skin partially heals.

BAKING POWDER.—Tartaric acid, 5 lbs.; pure sesquicarbonate of soda, 8 lbs.; potato farina, or other flour or starch, 16 lbs. Dry separately by gentle heat. Mix this perfectly in a dry room, pass the mixture through a sieve and put up at once into damp proof hard pressed packages. To use, 1 or 2 teaspoonfulls are mixed with dry flour, which is then mixed with cold water, and baked immediately. *Another*.—Tartaric acid, 1 lb.; pure bicarbonate of soda $\frac{3}{4}$ lbs.; potato farina, $\frac{1}{2}$ lb. Treat the same as the last.

COMPOUND EXTRACT BUCHU.—Buchu, in coarse powder, 12 oz.; alcohol, 3 pts.; water, 6 pts. are sufficient. Treat the leaves by maceration and displacement, first with a portion of the alcohol and then with the remainder mixed with the water, evaporate the resulting liquid with a gentle heat to three pints, and add $2\frac{1}{2}$ lbs. sugar, continue the heat till it is dissolved, and after removing from the fire, add oil of cubebs, oil of juniper; of each 1 fluid dr.; spirit of nitric ether, 12 fluid ozs., previously mixed, stir together.

COMPOUND SYRUP OF HYPOPHOSPHITES.—Take of hypophosphite of lime, $1\frac{1}{2}$ oz.; hypophosphite of soda $\frac{1}{2}$ oz.; hypophosphite of potassa, $\frac{1}{2}$ oz.; cane sugar, 1 lb. troy; hot water, 20 fluid ozs.; orange water, 1 fluid oz. Mix a solution of the mixed salts in the hot water, filter through paper, dissolve the sugar in the solution by heat, and strain, and add the orange flower water. Dose, a teaspoonful, containing nearly five grains of the mixed salts.

DAVIS' PAIN KILLER IMPROVED.—Powdered gnaïac. 20 lbs.; camphor, 2 lbs.; powdered cayenne pepper, 6 lbs.; caustic liquor of ammonia, 1 lb.; powdered opium, $\frac{1}{2}$ lb.; digest these ingredients in 32 gals. alcohol for 3 weeks, and filter.

COMPOUND SYRUP OF HYPHOSPHITE AND IRON.—Dissolve 256 grs. each of hypophosphites of soda, lime and potassa, and 126 grs. hypophosphite of iron, in 12 ozs. water, by a water bath. Filter and add sufficient water to make up for the evaporation. Add 18 ozs. sugar by gentle heat, to make 21 fluid ozs. syrup. Each fluid oz. contains 12 grs. each of the hypophosphites of soda, lime and potassa, and six grs. hypophosphite of iron.

CURE FOR DRUNKENNESS.—*Warranted a certain Remedy.* Confine the patient to his room, furnish him with his favorite liquor at discretion, diluted with $\frac{3}{4}$ of water, as much wine, beer, coffee and tea as he desires, but containing $\frac{1}{4}$ of spirit; all the food—the bread, meat and vegetables steeped in spirit and water. On the fifth day of this treatment he has an extreme disgust for spirit, being continually drunk. Keep up this treatment till he no longer desires to eat or drink, and the cure is certain.

RAREY'S LINIMENT.—Sulphuric ether, 4 ozs.; hartshorn, 4 ozs.; oil of origanum 4 ozs.; alcohol, 4 ozs.; sweet oil, 4 ozs. Shake well before using. For sprains, use a tight flannel bandage, four inches wide. For headache, rub a little on the temples and apply a bandage with the liniment to the forehead.

RAREY'S WIZARD OIL.—Oil of origanum, 6 ozs.; alcohol, 6 ozs.; spirits turpentine, 1 oz.; camphor, 1 oz. Shake well before using.

INJECTION FOR OBSTRUCTED MENSTRUATION.—Mix 1 to 2 fluid drs. liquor of ammonia with 1 pt. milk; use thrice daily.

TO CURE VOMITING IN PREGNANCY.—Mix 1 dr. carbonate of magnesia; $\frac{1}{2}$ oz. tinct. of colombo; $5\frac{1}{2}$ oz. peppermint water. Dose, 1 tablespoonful 3 times a day.

HARLAND'S VENEREAL CURE.—Mix together powdered cubebs, $1\frac{1}{2}$ ozs.; balsam capaiba, $\frac{1}{2}$ oz.; powdered gum arabic, $\frac{1}{2}$ oz.; cinnamon water, 3 ozs. A tablespoonful of the mixture to be taken at intervals 8 times a day.

FOR DISEASE OF THE KIDNEYS.—Boil 1 oz. of pareira brava in 3 pts. of water down to 1 pt. Dose, a wine glassful three times per day.

INCONTINENCE OF URINE OF OLD PEOPLE.—The continued use of 1 to 6 drops tinct. of iodine has proved a successful remedy. For other persons, put 4 drops tincture of aconite root in a tumbler of water, and use a teaspoonful every half hour until relieved.

WASH FOR REMOVING PARTICLES OF ZINC OR IRON FROM THE EYE.—Muriatic acid, 20 drops; mucilage, 1 dr.; mix with 2 fluid ozs. rose water. Iron or steel particles may be extracted by holding near them a powerful magnet.

TO REMOVE TUMORS.—Dr. Simpson of Edinburgh introduces a hollow acupuncture needle, or very fine trocar (a surgical instrument in the form of a fine hollow needle) into their tissue, and injects a few drops of some irritant liquid such as a solution of chloride of zinc; perchloride of iron, or creosote. The effect is to destroy the vitality of the tumors so treated, and admit of separating them.

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TWIGG'S HAIR-COLORING.—Take 1 dr. lac sulphur, $\frac{1}{2}$ dr. sugar of lead, 4 oz. rose water; mix carefully. Apply to the hair repeatedly, till it assumes the desired shade.

ALPINE HAIR-BALM.—To 16 oz. of soft water add 8 oz. of alcohol and $\frac{1}{2}$ oz. spirits turpentine, $\frac{1}{4}$ oz. sulphur, and $\frac{1}{4}$ oz. sugar of lead.

GLYCERINE PREPARATION.—New rum, 1 qt.; concentrated spirits, of ammonia, 15 drops; glycerine oil, 1 oz.; lac sulphur, $\frac{5}{8}$ drs.; sugar of lead, $\frac{5}{8}$ drs.; put the liquor into a bottle, add the ammonia, then the other components. Shake the compound occasionally for four or five days.

CRYSTALLINE CREAM.—Oil of almond, 8 oz.; spermaceti, 1 oz.; melt together. When a little cooled, add $\frac{1}{2}$ oz. or less of essence of bergamot or other perfume; put into wide-mouthed bottles, and let it stand till cold. Camphorated crystalline cream may be made by using camphorated oil (L. Champhoræ) instead of oil of almonds.

MACASSAR OIL.—Olive oil, 1 qt.; alcohol, $2\frac{1}{2}$ oz.; rose oil, $1\frac{1}{2}$ oz.; then tie 1 oz. of chipped alkanet root in a muslin bag, and put it in the oil, let it alone for some days till it turns the color of a pretty red, then remove to other oils. Do not press it.

OX MARROW.—Melt 4 oz. ox tallow; white wax, 1 oz.; fresh lard, 6 oz.; when cold, add $1\frac{1}{2}$ oz. oil of bergamot.

BEAR'S OIL.—Use good sweet lard oil, 1 qt., oil bergamot, $1\frac{1}{2}$ oz.

HAIR RESTORATIVE.—Sugar of lead, borax and lac sulphur, of each, 1 oz.; aqua ammonia, $\frac{1}{2}$ oz.; alcohol, 1 gill. These articles are to stand mixed for 14 hours; then add bay rum, 1 gill: fine table salt, 1 tablespoon; soft water, 3 pts.; essence of bergamot, 1 oz. This preparation gives a splendid glossy appearance to the hair, turns gray hair to a dark color, and restores the hair when common baldness sets in. When the hair is thin or bald, apply twice a day with a hard brush, working it into the roots of the hair. For gray hair once a day is sufficient.

BALM OF A THOUSAND FLOWERS.—Deodorized alcohol, 1 pt.; nice white bar soap, 4 oz.; shave the soap when put in, stand in a warm place till dissolved; then add oil of citronella, 1 dr.; and oils of neroli and rosemary, of each $\frac{1}{2}$ dr.

NEW YORK BARBER'S STAR HAIR OIL.—Castor oil $6\frac{1}{2}$ pts.; alcohol, $1\frac{1}{2}$ pts.; citronella and lavender oil, each $\frac{1}{2}$ oz.

BARBER'S SHAMPOO MIXTURE.—Soft water, 1 pt.; sal soda, 1 oz.; cream tartar, $\frac{1}{4}$ oz. Apply thoroughly to the hair.

FRANGIPANNI.—Spirits, 1 gal.; oil bergamot, 1 oz.; oil of lemon, 1 oz.; macerate for 4 days, frequently shaking; then add water, 1 gal.; orange-flower water, 1 pint, essence of vanilla, 2 oz. Mix.

JOCKEY CLUB.—Spirit of wine, 5 gal.; orange-flower water, 1 gal.; balsam of Peru, 4 oz.; essence of bergamot, 8 oz.; essence of musk, 8 oz.; essence of cloves, 4 oz.; essence of neroli, 2 oz. Mix.

LADIES' OWN.—Spirits of wine, 1 gal.; otto of roses, 20 drops; essence of thyme, $\frac{1}{2}$ oz.; essence of neroli, $\frac{1}{4}$ oz.; essence of vanilla, $\frac{1}{2}$ oz.; essence of bergamot, $\frac{1}{4}$ oz.; orange-flower water, 6 oz.

KISS ME QUICK.—Spirit, 1 gal.; essence of thyme, $\frac{1}{4}$ oz.; essence of orange-flowers, 2 oz.; essence neroli, $\frac{1}{4}$ oz.; otto of roses, 30 drops; essence of jasmine, 1 oz.; essence of balm mint $\frac{1}{2}$ oz. petals of

roses, 4 oz.; oil lemon, 20 drops; calorus aromaticus, $\frac{1}{2}$ oz. essence neroli, $\frac{1}{2}$ oz. Mix and strain.

UPPER TEN.—Spirits of wine, 4 qts.; essence of cedrat, 2 drs.; essence of violets, $\frac{1}{2}$ oz.; essence of neroli, $\frac{1}{2}$ oz.; otto of roses, 20 drops; orange-flower essence, 1 oz.; oil of rosemary, 30 drops; oils bergamot and neroli, each $\frac{1}{2}$ oz.

INDIA CHOLAGOGUE.—Quinine, 20 grs.; peruvian bark, pulverized, 1 oz.; sulphuric acid, 15 drops, or 1 scruple of tartaric acid is best; brandy, 1 gill; water to make one pint; dose, 5 teaspoonfuls every 2 hours in the absence of fever, an excellent remedy.

FEBRIFUGE WINE.—Quinine, 25 grs.; water, 1 pint; sulphuric acid, 15 drops; epsom salts, 2 oz.; color with tincture of red sanders; dose, a wine glass 3 times per day. This is a world renowned medicine.

BARRELL'S INDIAN-LINIMENT.—Alcohol, 1 qt.; tincture of capsicum, 1 oz.; oil of origanum, sassafras, pennyroyal, and hemlock, of each $\frac{1}{2}$ oz. Mix.

COD LIVER OIL, as usually prepared, is nothing more or less than cod oil clarified, by which process it is in fact deprived in a great measure of its virtue. Cod oil can be purchased from any wholesale oil dealer for one thirtieth part of the price of cod liver oil as usually sold, and it is easy to clarify it. Dealers might turn this information to good account. To make it more palatable and digestible, put 1 oz. of fine table salt to each quart bottle.

SIMPLE REMEDIES FOR SCARLET FEVER.—Open the bowels regularly every day, with some mild aperient medicine, such as castor oil, senna, etc., and keep the patient at rest, and comfortably warm; sponge the surface with tepid water, two or three times a day; while it is hotter than natural, admit fresh air; live on a bland diet, such as a cupful of arrowroot, several times a day; toast-water for common drink. Gargle made of strong sage tea, honey and alum, or borax, may be used from the commencement, if the throat is affected.

PAREGORIC.—Best opium, $\frac{1}{2}$ dr., dissolve it in about 2 tablespoons of boiling water; then add benzoic acid, $\frac{1}{2}$ dr.; oil of anise, $\frac{1}{4}$ a fluid dr.; clarified honey, 1 oz.; camphor gum, 1 scruple; alcohol, 76 per cent, 11 fluid oz.; distilled water, 4 fluid oz.; macerate (keep warm) for two weeks. Dose—For children, 5 to 20 drops, adults, 1 to 2 teaspoons.

COUGH SYRUP.—Put 1 qt. hoarhound tea; 1 qt. of water, and boil it down to 1 pt.; add 2 or 3 sticks licorice; 2 oz. syrup of squills, and a tablespoonful essence of lemon. Take a tablespoonful 3 times a day, or as the cough requires.

COUGH SYRUP.—Syrup of squills, 2 oz.; tartarized antimony, 8 grs.; sulphate of morphine, 5 grs.; pulverized gum arabic, $\frac{1}{2}$ oz.; honey, 1 oz.; water, 1 oz., mix: dose for an adult 1 small teaspoonful, repeat in half an hour if it does not relieve: child in proportion.

VEGETABLE SUBSTITUTE FOR CALOMEL.—Jalap, 1 oz., senna, 2 oz., peppermint, 1 oz. (a little cinnamon if desired,) all pulverized and sifted through gauze. Dose, 1 teaspoonful put in a cup with 2 or 3 spoonfuls of hot water, and a good lump of white sugar; when cool, drink all; to be taken fasting in the morning; drink

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freely, if it does not operate in 3 hours repeat $\frac{1}{2}$ the quantity, use instead of calomel.

STAMMERING.—Impediments in the speech may be cured, where there is no mal-formation of the organs of articulation, by perseverance, for three or four months, in the simple remedy of reading aloud, with the teeth closed, for at least 2 hours in the course of each day.

COLD IN THE HEAD.—Dr. Pollion, of France, says that cold in the head can be cured by inhaling hartshorn. The inhalation by the nose should be seven or eight times in five minutes.

CAMPHOR ICE.—Spermaceti, $\frac{1}{4}$ oz., gum camphor, $\frac{3}{4}$ oz., oil sweet almonds, 4 teaspoonfuls; set on the stove in an earthen dish till dissolved; heat just enough to dissolve it. While warm pour into small moulds, if desired to sell; then paper, and put into tinfoil; used for chaps on hands or lips.

IMPERIAL DROPS FOR GRAVEL AND KIDNEY COMPLAINTS.—Oil of organum, 1 oz., oil of hemlock, $\frac{1}{4}$ oz., oil of sassafras, $\frac{1}{4}$ oz., oil of anise, $\frac{1}{4}$ oz., alcohol, 1 pint: mix. Dose, from $\frac{1}{4}$ to 1 teaspoonful 3 times a day, in sweetened water, will soon give relief when constant weakness is felt across the small of the back, as well as gravelly affections causing pain about the kidneys.

POSITIVE CURE FOR GONORRHOEA.—Liquor of potass, $\frac{1}{4}$ oz., bitter apple, $\frac{1}{4}$ oz., spirits of sweet nitre, $\frac{1}{4}$ oz., balsam of copaiba, $\frac{1}{4}$ oz., best gum, $\frac{1}{4}$ oz. To use, mix with peppermint water; take $\frac{1}{4}$ teaspoonful 3 times per day: cure certain in 9 days.

CELEBRATED PILE OINTMENT.—Take carbonate of lead, $\frac{1}{4}$ oz., sulphate of morphia, 15 grs.; stramonium ointment, 1 oz.; olive oil, 20 drops. Mix, and apply 3 times per day, or as the pain may require.

FLY PAPER.—Coat paper with turpentine varnish, and oil it to keep the varnish from drying.

SWEATING DROPS.—Ipecac., saffron, boneset, and camphor gum, of each, 3 oz.; opium, 1 oz., alcohol, 2 qts. Let stand 2 weeks and filter. A teaspoonful in a cup of hot sage or catnip tea every hour until free perspiration is induced; excellent in colds, fevers, inflammations, &c. Bathe the feet in hot water at the same time.

SYRUP FOR CONSUMPTIVES.—Of tamarac bark, take from the tree without roasting, 1 peck; spikenard root, $\frac{1}{4}$ lb.; dandelion root, $\frac{1}{4}$ lb.; hops, 2 oz. Boil these sufficient to get the strength in 2 or 3 gals. water; strain, and boil down to 1 gal.; when blood warm, add 3 lbs. best honey, and 3 pints best brandy; bottle and keep in a cool place. Dose, drink freely of it 3 times per day before meals, at least a gill or more; cure very certain.

COMMON CASTOR OIL.—Pale vegetable oil, 1 gal., castor oil, 3 gals. Mix.

PULMONIC WAFERS.—Lump sugar, licorice, and starch, of each 2 parts; gum, 10 parts; squills and ipecacuanha, of each 5 parts; lactucarium, 2 parts. Mix, and divide into 8-grain lozenges.

SIR JAMES CLARKE'S DIARRHOEA AND CHOLERA MIXTURE.—Tinct. of opium, tinct. of camphor, and spirits of turpentine, of each 3 drams; oil of peppermint, 30 drops; mix. Dose, 1 teaspoonful in brandy and water for diarrhoea; 1 tablespoonful for cholera

VEGETABLE OR COMPOSITION POWDER.—Fine bayberry bark, 1 lb., ginger 8 oz., common cayenne, 3 oz., mix. Dose, 1 teaspoonful in a cup of boiling water, sweeten and add milk. The best powder on record.

TINCTURES are made with 1 oz. of gum, root, or bark, &c., dried, to each pint of proof spirits, and let it stand one week, and filter.

ESSENCES are made with 1 oz. of any given oil, added to 1 pint alcohol. Peppermints are coloured with tinct. turmeric, cinnamon with tinct. of red sanders, wintergreen with tinct. kino.

SUBSTITUTE FOR ARROWROOT.—Finest potato starch, 75 lbs.; lump sugar, 8 lbs.; finely-ground rice, 21 lbs. Mix, and sift through lawn; yields 100 lbs. excellent arrowroot.

CERTAIN CURE FOR GOUT.—Goose oil and urine equal parts. Dose, 1 teaspoonful. A certain cure if taken in time.

CORNS AND WARTS.—Take a small quantity of the potash paste recommended for Poll Evil, and apply to the corn or wart.

DRUGGIST'S COLORS.—*Yellow*, take iron filings, hydrochloric acid to dissolve, dilute with cold water. *Red*, solution of sal ammoniac, cochineal to color. *Blue*, indigo 1 part, oil of vitriol, 2 parts, dissolve, then dilute with water. *Green*, verdigris, 1 part, acetic acid, 3 parts, dilute with water. *Purple*, cochineal, 25 grs., sugar of lead 1 oz., dissolve.

SMELLING SALTS.—Sub-carbonate of ammonia, 8 parts; put it in coarse powder in a bottle, and pour on it oil of lavender, 1 part.

TUNBRIDGE WELLS WATER.—Chloride of sodium, 5 grains; tinct. steel, 20 drops; distilled water, 1½ pints.

MINERAL WATER.—Epsom salts, 1 oz.; cream tartar, ½ oz.; tartaric acid, ¼ oz.; loaf sugar, 1 lb.; oil of birch, 20 drops; put 1 qt. cold water on 2 tablespoonfuls yeast (winter green oil will do), let it work 2 hours and then bottle.

GENUINE SEIDLITZ POWDERS.—Rochelle salts, 2 drs.; bicarb. soda, 2 scruples; put these into a blue paper and put 35 grains tartaric acid into a white paper. To use, put each into different tumblers, fill ½ with water, adding a little loaf sugar to the acid, then pour together and drink quick.

BOTTLED SEIDLITZ WATER.—Fill soda-water bottles with clear water; add to each as below; cork and wire immediately: Rochelle salts, 3 drops; bicarbonate of soda, 35 grs.; sulphuric acid, 11 drops.

EXCELLENT TOOTH POWDER.—Suds of Castile soap and spirits of camphor, of each an equal quantity; thicken with equal quantities of pulverized chalk and charcoal to a thick paste. Apply with the finger or brush.

RAT EXTERMINATOR.—Warm water, 1 qt.; lard, 2 lbs.; phosphorus, 1 oz.; mix, and thicken with flour; to be spread on bread and covered with sugar.

BUG POISON.—Alcohol, ½ pint; turpentine, ½ pint; crude sal ammoniac, 1 oz.; mix all together, and let it digest in a warm place for a few days, and it is ready for use.

ME ICATED COUGH CANDY.—To 5 lbs. candy just ready to pour on the slab, add the following mixture, and form it into sticks to correspond with the price asked for them: Tinct. aquilla, 2 oz.; cam-

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phorated tinct. of opium and tinct. of tolu, of each $\frac{1}{2}$ oz.; wine of ipecac., $\frac{1}{2}$ oz.; oils of gaultheria, 4 drops; sassafras, 8 drops; and of anise seed oil, 2 drops, and use this freely in common coughs.

ATKINSON'S INFANTS' PRESERVATIVE.—Carbonate of magnesia, 6 drs.; sugar, 2 oz.; oil of anise seed, 20 drops; sal-volatile, $2\frac{1}{2}$ drs.; laudanum, 1 dr.; syrup of saffron, 1 oz. Make up 1 pint with carraway water.

AGUE PILL.—Quinine, 20 grs.; Dover's powders, 10 grs.; sub-carbonate of iron, 10 grs.; mix with macilage of gum arabic and form into 20 pills. Dose, 2 each hour, commencing 5 hours before the chill should set in. Then take 1 night and morning until all are taken.

PILLS TO PROMOTE MENSTRUAL SECRETION.—Take pills of aloes and myrrh, 4 drs.; compound iron pills, 280 grs.; mix and form into 100 pills. Dose, 2 twice a day.

FOR OBSTRUCTED MENSTRUATION.—Sulphate of iron, 60 grs.; potassa (sub carb.) 60 grs.; myrrh, 2 drs.; make them into $3\frac{1}{2}$ gr. pills; 2 to be taken three times a day, in the absence of fever. For painful menstruation, take pulv. rhei, 2 drs.; pulv. jalap, 2 dr.; syrup of op. of poppies to mix. Divide into 200 pills, and take night and morning. To check immoderate flow—Tinct. of ergot, 1 oz., liquor of ammonia, 3 drs.; mix. Dose, teaspoonful in water 3 times a day.

STIMULANT.—IN LOW FEVERS, AND AFTER UTERINE HEMORRHAGES.—Best brandy and cinnamon water, of each, 4 fluid oz.; the yolks of 2 eggs, well beaten; loaf sugar, $\frac{1}{2}$ oz.; oil of cinnamon, 2 drops; mix. Dose, From $\frac{1}{2}$ to 1 (fluid) oz., as often as required. This makes both meat and drink. Of course, any other flavoring oils can be used, if preferred, in place of the cinnamon.

FOR FEMALE COMPLAINTS.—One of the best laxative pills for female complaints is macrotin and rhubarb, each 10 grs.; extract of hyoscyamus 10 grs.; Castile soap, 40 grs.; scrape the soap, and mix well together, forming into common sized pills with gum solution. Dose, 1 pill at bed time, or sufficiently often to keep the bowels in a laxative state.

ANODYNE FOR PAINFUL MENSTRUATION.—Extract of stramonium and sulphate of quinine, each 16 grs.; macrotin, 8 grs.; morphine, 1 gr.; make into 8 pills. Dose, 1 pill, repeating once or twice only, 40 to 50 minutes apart, if the pain does not subside before this time. Pain must subside under the use of this pill, and costiveness is not increased.

POWDER FOR EXCESSIVE FLOODING.—Gums kino and catechu, each 1 dr.; sugar of lead and alum, each $\frac{1}{2}$ dr.; pulverize all and thoroughly mix, then divide into 7 to 10 grain powders. Dose, one every 2 or 3 hours until checked, then less often merely to control the flow.

INJECTION FOR LEUCORRHEA.—When the glairy mucus discharge is present, prepare a tea of hemlock inner bark and witch hazel (often called spotted alder) leaves and bark, have a female syringe large enough to fill the vagina, and inject the tea, twice daily; and occasionally in bad cases, say twice a week, inject a syringe of the following composition:

FOR CHRONIC FEMALE COMPLAINTS.—White vitriol and sugar of lead, each, $\frac{1}{2}$ oz.; common salt, pulverized alum, and loaf sugar, each, $\frac{1}{2}$ dr.; soft water, 1 pt. Inject as above.

FOR PRELAPUS UTERI, OR FALLING OF THE WOMB.—Not only the cheapest but the best support will be found to be a piece of fine firm sponge, cut to a proper size, to admit when damp of being pressed up the vagina to hold the womb in its place. The sponge should have a stout piece of small cord sewed 2 or 3 times through its centre, up and down, and left sufficiently long to allow its being taken hold of to remove the sponge, once a day, or every other day at the farthest, for the purpose of washing, cleaning, and using the necessary injections; and this must be done while the patient is lying down, to prevent the womb from again falling or prolapsing. After having injected some of the above tea, wet the sponge in the same, and introduce it sufficiently high to hold the womb in its place. If pain is felt about the head, back, or loins for a few days before the menses appear, prepare and use the following:

EMMENAGOGUE TINCTURE.—Alcohol, 1 pt.; red oxide of iron, 1 oz.; oils of juniper and savin, each $\frac{1}{2}$ oz.; oil of tansy, 1 dr.; tincture of ergot, 3 drs.; tincture Spanish flies, $\frac{1}{2}$ oz.; mix all, and shake when taken. Dose, 1 teaspoon 3 times daily, to be taken in mucilage of slippery elm or gum arabic, and drink freely of the mucilage also through the day, or use the following:

EMMENAGOGUE PILL.—Precipitated carbonate of iron and gum myrrh, of each 2 drs.; aloes and tincture of Spanish flies, of each 1 dr.; and oil of savin, 1 dr.; all to be pulverized, and made into 100 pills by using thick gum solution. Dose, 1 pill, from 1 to 3 times daily, but not to move the bowels too much.

UTERINE HEMORRHAGES.—Unfailing cure. Sugar of lead, 10 grs.; ergot, 10 grs.; opium, 3 grs.; ipecac., 1 gr.; all pulverized and well mixed. Dose, 10 to 12 grs.; given in a little honey or syrup.

In very bad cases after childbirth, it might be repeated in 30 minutes, or the dose increased to 15 or 18 grs.; but in cases of rather profuse wasting, repeat it once at the end of 3 hours, or as the urgency of the case may require.

In every case of female debility make a liberal use of iron, as the want of iron in the system is often the cause of the trouble. Mix fine iron filings with as much ground ginger. Dose, half of a teaspoon 3 times daily in a little honey or molasses, increasing or lessening the dose to produce blackness of the stools. Continue this course until well.

NERVE AND BONE LINIMENT.—Beef's gall, 1 qt.; alcohol, 1 pt.; volatile liniment, 1 lb.; spts. of turpentine, 1 lb.; oil organum, 4 oz.; aqua ammonia, 4 oz.; tincture of cayenne, $\frac{1}{2}$ pt.; oil of amber, 3 oz.; tincture Spanish flies, 6 oz.; mix well.

CEPHALIC SNUFF.—Take asarabacca leaves, marjoram, light Scotch snuff, equal parts; grind them and sift, use like common snuff.

DOWNER'S SALVE.—Beeswax, 4 oz.; opium, $\frac{1}{2}$ oz.; sugar of lead, 1 oz.; melt the beeswax, and rub the lead up in the wax, then the opium, then 1 gill of sweet oil, incorporate all thoroughly together, spread lightly on cloth; good for burns, piles, &c.

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ANOTHER SALVE.—Burgundy pitch, beeswax, white pine pitch, and rosin, 1 oz. each, mutton tallow, 8 oz.; goose oil, 1 gill, tar, 1 gill, melt and mix thoroughly. A first-rate salve.

WHOOPING COUGH SYRUP.—Best rum, 1 pt.; anise oil, 2 ozs.; honey, 1 pt.; lemon juice, 4 oz., mix. Dose for adults, 1 tablespoonful, 3 or 4 times per day; children 1 teaspoon, with sugar and water.

LIQUID OPODELDOC.—Warm brandy, 1 qt.; add to it gum camphor, 1 oz.; sal ammoniac, $\frac{1}{2}$ oz.; oils of origanum and rosemary, each $\frac{1}{2}$ oz.; oil wormwood, $\frac{1}{2}$ oz.; when the oils are dissolved, add 6 oz. soft soap.

GREEN MOUNTAIN SALVE.—For rheumatism, burns, pains in the back or side, &c., take 2 lbs. rosin burgundy pitch, $\frac{1}{2}$ lb.; beeswax, $\frac{1}{2}$ lb.; mutton tallow, $\frac{1}{2}$ lb.; melt slowly; when not too warm, add oil hemlock, 1 oz.; balsam fir, 1 oz.; oil of origanum, 1 oz.; oil of red cedar, 1 oz.; Venice turpentine, 1 oz.; oil of wormwood, 1 oz.; verdigris, $\frac{1}{2}$ oz. The verdigris must be finely pulverized and mixed with the oils; then add as above, and work in cold water like wax till cold enough to roll; rolls 5 inches long, 1 inch diameter, sell for 25 cents.

ENGLISH REMEDY FOR CANCER.—Take chloride of zinc, blood-root pulverized, and flour, equal quantities of each, worked into a paste and applied. First spread a common sticking-plaster much larger than the cancer, cutting a circular piece from the centre of it a little larger than the cancer, applying it, which exposes a narrow rim of healthy skin; then apply the cancer plaster, and keep it on 24 hours. On removing it, the cancer will be found to be burned into, and appears the color of an old shoe-sole, and the rim outside will appear white and parboiled, as if burned by steam. Dress with slippery elm poultice until suppuration takes place, then heal with any common salve.

CHRONIC GOUT—TO CURE.—Take hot vinegar, and put into it all the table salt which it will dissolve, and bathe the parts affected with a soft piece of flannel. Rub in with the hand, and dry the foot, &c., by the fire. Repeat this operation four times in the 24 hours, 15 minutes each time, for four days; then twice a day for the same period; then once, and follow this rule whenever the symptoms show themselves at any future time.

GOUT TINCTURE.—Veratrum viride (swamp hellebore), $\frac{1}{2}$ oz.; opium, $\frac{1}{2}$ oz.; wine, $\frac{1}{2}$ pt.; let them stand for several days. Dose, 15 to 30 drops, according to the robustness of the patient, at intervals of 2 to 4 hours.

PARALYTIC LINIMENT.—Sulphuric ether, 6 oz.; alcohol, 2 oz.; laudanum, 1 oz.; oil of lavender, 1 oz.; mix, and cork tightly. In a recent case of paralysis let the whole extent of the numb surface be thoroughly bathed and rubbed with this preparation, for several minutes, using the hand, at least three times daily; at the same time take internally, 20 drops of the same, in a little sweetened water, to prevent translation upon some internal organ.

CHARCOAL A CURE FOR SICK HEADACHE.—It is stated that 2 tea spoons of finely powdered charcoal, drank in $\frac{1}{2}$ a tumbler of water will, in less than fifteen minutes, give relief to the sick headache,

when caused, as in most cases it is, by superabundance of acid on the stomach. We have frequently tried this remedy, and its efficacy in every instance has been signally satisfactory.

CATHARTIC SYRUP.—Best senna leaf, 1 oz.; butternut, the inner bark of the root, dried and bruised, 2 oz.; peppermint leaf, $\frac{1}{2}$ oz.; fennel seed, $\frac{1}{2}$ oz.; alcohol, $\frac{1}{2}$ pt.; water, $1\frac{1}{2}$ pts.; sugar, 2 lbs.; put all into the spirit and water, except the sugar, and let it stand two weeks, then strain, pressing out from the dregs, adding the sugar and simmering a few minutes only, to form the syrup. If it should cause griping in any case, increase the fennel seed and peppermint leaf. Dose, 1 tablespoon, once a day, or less often if the bowels become too loose, up to the next period when the headache might have been expected, and it will not be forthcoming.

CHILBLAINS.—To CURE.—Mutton tallow and lard, of each $\frac{1}{2}$ lb.; melt in an iron vessel, and add hydrated oxyde of iron, 2 oz.; stirring continually with an iron spoon, until the mass is of a uniform black color; then let it cool, and add Venice turpentine, 2 oz.; Armenian bole, 1 oz.; oil of bergamot, 1 dr.; rub up the bole with a little olive oil before putting it in.

FELONS.—If RECENT, TO CURE IN SIX HOURS.—Venice turpentine, 1 oz.; and put into it half a teaspoon of water, and stir with a rough stick until the mass looks like candied honey; then spread a good coat on a cloth, and wrap around the finger. If the case is only recent, it will remove the pain in six hours.

FELON SALVE.—A salve made by burning one tablespoon of copperas, then pulverizing it and mixing it with the yolk of an egg, is said to relieve the pain, and cure the felon in 24 hours; then heal with cream two parts, and soft soap one part. Apply the healing salve daily after soaking the part in warm water.

FELON OINTMENT.—Take sweet oil, $\frac{1}{2}$ pt., and stew a 3-cent plug of tobacco in it until the tobacco is crisped; then squeeze it out, and add red lead, 1 oz.; and boil until black; when a little cool, add pulverized camphor gum, 1 oz.

WARTS AND CORNS.—To CURE IN TEN MINUTES.—Take a small piece of potash, and let it stand in the open air until it slacks, then thicken it to a paste with pulverized gum arabic, which prevents it from spreading where it is not wanted.

GERMAN RHEUMATIC FLUID.—Oils of hemlock and cedar, of each $\frac{1}{2}$ oz.; oils of origanum and sassafras, each 1 oz.; aqua ammonia, 1 oz.; capsicum pulverized, 1 oz.; spirits of turpentine and gum camphor, each $\frac{1}{2}$ oz.; put all into a quart bottle, and fill with 95 per cent alcohol.

Dose, for colic, for man, half a teaspoonful; for a horse, $\frac{1}{2}$ to 1 oz., in a little warm water, every 15 minutes, till relieved.

LINIMENT FOR OLD SORES.—Alcohol, 1 qt.; aqua ammonia, 4 oz.; oil of origanum, 2 oz.; camphor gum, 2 oz.; opium, 2 oz.; gum myrrh, 2 oz.; common salt, two tablespoons. Mix, and shake occasionally for a week.

LINIMENT.—GOOD SAMARITAN.—Take 98 per cent. alcohol, 2 qts.; and add to it the following articles: Oils of sassafras, hemlock, spirits of turpentine, tincture of cayenne, catechu, guaiac (guay), and laudanum, of each, 1 oz.; tincture of myrrh, 4 oz.; oil of origanum, 2 oz.; oil of wintergreen, $\frac{1}{2}$ oz.; gum camphor. 2 oz.; and

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chloroform, $1\frac{1}{2}$ oz. This is one of the best applications for internal pains known: it is superior to any other enumerated in this work.

COOK'S ELECTRO-MAGNETIC LINIMENT.—Best alcohol, 1 gal.; oil of amber, 8 oz.; gum camphor, 8 oz.; Castile soap, shaved fine, 2 oz.; beef's gall, 4 oz.; ammonia, 3 F.'s strong, 12 oz.; mix, and shake occasionally for 12 hours, and it is fit for use. This will be found a strong and valuable liniment.

LONDON LINIMENT.—Take chloroform, olive oil, and aqua ammonia, of each 1 oz.; acetate of morphia, 10 grs. Mix and use as other liniments. Very valuable.

ONTSMENTS.—FOR OLD SORES.—Red precipitate, $\frac{1}{2}$ oz.; sugar of lead, $\frac{1}{2}$ oz.; burnt alum, 1 oz.; white vitriol, $\frac{1}{2}$ oz., or a little less; all to be very finely pulverized; have mutton tallow made warm, $\frac{1}{2}$ lb.; stir all in, and stir until cool.

JUDKIN'S OINTMENT.—Linseed oil, 1 pt.; sweet oil, 1 oz.; and boil them in a kettle on coals for nearly 4 hours, as warm as you can; then have pulverized and mixed borax, $\frac{1}{2}$ oz.; red lead, 4 oz.; and sugar of lead, $1\frac{1}{2}$ oz.; remove the kettle from the fire, and thicken in the powder; continue the stirring until cooled to blood heat, then stir in 1 oz. of spirits of turpentine; and now take out a little, letting it get cold, and if not then sufficiently thick to spread upon thin soft linen as a salve, you will boil again until this point is reached. It is good for all kinds of wounds, bruises, sores, burns, white swellings, rheumatisms, ulcers, sore breasts; and even where there are wounds on the inside, it has been used with advantage, by applying a plaster over the part.

GREEN OINTMENT.—Honey and bees'-wax, each $\frac{1}{2}$ lb.; spirits of turpentine, 1 oz.; wintergreen oil and laudanum, each 2 oz.; verdigris, finely pulverized, $\frac{1}{2}$ oz.; lard, $1\frac{1}{2}$ lb.; mix by a stove fire, in a copper kettle, heating slowly.

MEAD'S SALT-RHEUM OINTMENT.—Aqua fortis, 1 oz.; quicksilver, 1 oz.; good hard soap, dissolved so as to mix readily, 1 oz.; prepared chalk, 1 oz.; mixed with 1 lb. of lard; incorporate the above by putting the aqua fortis and quicksilver into an earthen vessel, and when done effervescing, mix with the other ingredients, putting the chalk in last; add a little spirits of turpentine, say $\frac{1}{4}$ table-spoon.

ITCH OINTMENT.—Unsalted butter, 1 lb.; burgundy pitch, 2 oz.; spirits of turpentine, 2 oz.; red precipitate, pulverized, $1\frac{1}{2}$ oz.; melt the pitch and add the butter, stirring well together; then remove from the fire, and when a little cool add the spirits of turpentine, and lastly the precipitate, and stir until cold.

MAGNETIC OINTMENT.—SAID TO BE TRASK'S.—Hard raisins cut in pieces, and fine-cut tobacco, equal weights; simmer well together, then strain, and press out all from the dregs.

JAUNDICE.—IN ITS WORST FORMS.—Red iodide of mercury, 7 grs. iodide of potassium, 9 grs.; aqua dis. (distilled water) 1 oz.; mix. Commence by giving 6 drops 3 or 4 times a day, increasing 1 drop a day until 12 or 15 drops are given at a dose. Give in a little water, immediately after meals. If it causes a griping sensation in the bowels, and fullness in the head, when you get up to 12 or 15 drops, go back to 6 drops, and up again as before.

INFLAMMATORY RHEUMATISM.—Sulphur and saltpetre, of each 1 oz.; gum guaiac, $\frac{1}{2}$ oz.; colchicum root, or seed, and nutmegs, of each $\frac{1}{2}$ oz.; all to be pulverized and mixed with simple syrup, or molasses, 2 oz. Dose, one teaspoon every 2 hours until it moves the bowels rather freely; then 3 or 4 times daily until cured.

REMEDY FOR RHEUMATISM AND STIFF JOINTS.—Strong camphor spirits, 1 pt.; neat's-foot, coon, bear, or skunk's oil, 1 pt.; spirits of turpentine, $\frac{1}{2}$ pt. Shake the bottle when used, and apply 3 times daily, by pouring on a little at a time, and rubbing in all you can for 20 or 30 minutes.

ASTHMA REMEDIES.—Elecampane, angelica, comfrey, and spike-nard roots with hoarhound tops, of each 1 oz.; bruise and steep in honey, 1 pt. Dose, a tablespoon, taken hot every few minutes, until relief is obtained, then several times daily until a cure is effected.

ANOTHER.—Oil of tar, 1 dr.; tincture of veratrum viride, 2 drs.; simple syrup, 2 drs.; mix. Dose, for adults, 15 drops 3 or 4 times daily. Iodide of potassium has cured a bad case of asthma by taking 5 gr. doses 3 times daily. Take $\frac{1}{2}$ oz. and put it into a phial, and add 32 teaspoons of water; then 1 teaspoon of it will contain the 5 grs., which put into $\frac{1}{2}$ gill more water, and drink before meals.

COMPOSITION POWDER—THOMPSON'S.—Bayberry bark, 2 lbs.; hemlock bark, 1 lb.; ginger root, 1 lb.; cayenne pepper, 2 oz.; cloves, 2 oz.; all finely pulverized and well mixed. Dose, $\frac{1}{2}$ a teaspoon of it, and a spoon of sugar; put them into a tea-cup, and pour it half full of boiling water; let it stand a few minutes, and fill the cup with milk, and drink freely. If no milk is to be obtained, fill up the cup with hot water.

FRENCH REMEDY FOR CHRONIC RHEUMATISM.—Dr. Bonnet, of Graulbet, France, states in a letter to the "Abeille Medicale," that he has been long in the habit of prescribing "the essential oil of turpentine by friction for rheumatism; and that he has used it himself with perfect success, having almost instantaneously got rid of rheumatic pains in both knees and in the left shoulder."

DIURETICS—PILLS, DROPS, DECOCTION, &c.—Solidified copaiba, 2 parts; alcoholic extract of cubeba, 1 part; formed into pills with a little oil of juniper. Dose, 1 or 2 pills 3 or 4 times daily. This pill has been found very valuable in affections of the kidneys, bladder, and urethra, as inflammation from gravel, gonorrhœa, gleet, whites, leucorrhœa, common inflammations, &c. For giving them a sugar coat, see that heading, if desired.

DIURETIC DROPS.—Oil of cubeba, $\frac{1}{2}$ oz.; sweet spirits of nitre, $\frac{1}{2}$ oz.; balsam of copaiba, 1 oz.; Harlem oil, 1 bottle; oil of lavender, 20 drops; spirits of turpentine, 20 drops; mix. Dose, 10 to 25 drops, as the stomach will bear, three times daily.

It may be used in any of the above diseases with great satisfaction.

DIURETIC TINCTURE.—Green or growing spearmint mashed, put into a bottle, and covered with gin, is an excellent diuretic.

DIURETIC FOR CHILDREN.—Spirits of nitre—a few drops in a little spearmint tea—is all sufficient. For very young children, pumpkin-seed, or water-melon seed tea is perhaps the best.

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MAGNETIC PAIN KILLER, FOR TOOTHACHE AND ACUTE PAIN.—Laudanum 1 dr. gum camphor 4 drs. oil of cloves $\frac{1}{2}$ dr. oil of lavender 1 dr. add then to 1 oz. alcohol, 6 drs. sulphuric ether, and 5 fluid drs. chloroform. Apply with lint, or for toothache rub on the gums, and upon the face against the teeth.

CURE FOR SNAKE BITES.—The Inspector of Police in the Bengal Government reports that of 939 cases in which ammonia was freely administered 702 victims have recovered, and in the cured instances the remedy was not administered till about $3\frac{1}{2}$ hours after the attack, on the average of the fatal cases the corresponding duration of time was $4\frac{1}{2}$ hours.

NITROUS OXIDE, OR LAUGHING GAS.—Take two or three ounces of nitrate of ammonia in crystals and put it into a retort, taking care that the heat does not exceed 500° ; when the crystals begin to melt, the gas will be produced in considerable quantities. The gas may also be procured, though not so pure, by pouring nitric acid, diluted with five or six times its weight of water, on copper filings or small pieces of tin. The gas is given out till the acid begins to turn brown; the process must then be stopped.

TO INHALE THE LAUGHING GAS.—Procure an oiled or varnished silk bag, or a bladder, furnished with a stop-cock into the mouth and at the same time hold the nostrils, and the sensation produced will be of a highly pleasing nature, a great propensity to laughter, a rapid flow of vivid ideas, and an unusual fitness for muscular exertion, are the ordinary feeling which it produces. The sensation, produced by breathing this gas, are not the same in all persons, but they are of an agreeable nature, and not followed by any depression of spirits like those occasioned by fermented liquors.

CHEWING GUM.—Take of prepared balsam of tolu, 2 oz. white sugar 1 oz. oatmeal 3 ozs. soften the gum in a water bath and mix in the ingredients; then roll in finely-powdered sugar or flour to form sticks to suit.

BLACK STENCIL INK.—Triturate together 1 pt. pine soot and 2 pts Prussian blue with a little glycerine, then add 3 pts. gum arabic and sufficient glycerine to form a thin paste.

REMEDY FOR SMALL POX.—Sulphate of zinc 1 gr. foxglove [digitalis], 1 gr. sugar $\frac{1}{2}$ teaspoonful, mix with 2 teaspoonfuls of water, add 4 oz. of water, dose 1 spoonful every hour, child in proportion. From experience it is known that nothing will break up this frightful disease sooner than continued and persevering bathing with the water at a comfortable temperature. See page 254.

The four following receipts are said to be genuine.

AYER'S WILD CHERRY EXPECTORANT.—Mix together 3 grs. acetate of morphia, 2 fluid drs. tinct blood-root, 3 fluid drs. each antimonial wine and ipecacuanha wine, and 3 fluid ozs. syrup of wild cherry bark. Dose 1 teaspoonful in catarrh, bronchitis, and influenza.

RADWAY'S READY RELIEF.—According to Peckolt, is an ethereal tincture of capsicum, with alcohol and camphor.

RADWAY'S RENOVATING RESOLVENT.—A vinous tincture of ginger and cardamom, sweetened with sugar.

AYER'S SARSAPARILLA.—Take 3 fluid ozs. each of alcohol, fluid extracts of sarsaparilla and of stillingia; 2 fluid ozs. each, extract of yellow-dock and of podophyllin, 1 oz. sugar, 90 grs., iodide of potassium, and 10 grs. iodide of iron.

INHALATION OF TAR FOR CONSUMPTION.—Mix together 16 ozs. of liquid tar and 1 fluid oz. liquor of potassa, boil them for a few minutes in the open air, then let it simmer in an iron vessel over a spirit or other lamp in the chamber of the patient. This may at first excite a disposition to cough, but in a short time it allays it, and removes any tendency to it.

CANCER CURE.—Drink a tea made from the tops of red clover; about 1 qt. per day should be taken internally, and the tea should be used as a wash twice per day; very strongly recommended.

TAYLOR'S REMEDY FOR DEAFNESS.—Digest 2 ozs. bruised garlic in 1 lb. oil of almonds for a week and strain. A drop poured into the ear is effective in temporary deafness.

CURE FOR EARACHE.—Take equal parts of chloroform and laudanum, dip a piece of cotton into the mixture and introduce into the ear, and cover up and get to sleep as soon as possible.

OTTAWA ROOT BEER.—Take 1 oz. each of sassafras, allspice yellow-dock and winter green; $\frac{1}{2}$ oz. each wild cherry bark and coriander; $\frac{1}{4}$ oz. hops and 3 qts. molasses. Pour sufficient boiling water on the ingredients and let them stand 24 hours, filter the liquor and add $\frac{1}{2}$ pt. yeast, and it is ready for use in 24 hours.

TO EXTRACT ESSENTIAL OIL FROM WOOD, BARKS, ROOTS HERBS, &c.—Take balm, mint, sage, or any other herb, &c., put it into a bottle, and pour upon it a spoonful of ether; keep in a cool place a few hours, and then fill the bottle with cold water; the essential oil will swim upon the surface and may be easily separated.

FUMIGATING PAPER.—Dip light paper in a solution of alum, strength of alum 1 oz. water 1 pt. Dry thoroughly and on one side spread a mixture of equal parts of gum benzoin, oilbalm, or Peruvian balsam, melt the gums in an earthenware dish and spread with a hot spatula, slips of the paper are held over a light when the odorous matter will be evaporated, the alum preventing the paper from igniting.

TRANSPARENT CEMENT FOR GLASS.—Dissolve 1 part Indian rubber in chloroform, and add 16 parts by measure of gum mastic in powder. Digest for 2 days, shaking the bottle frequently, apply with a fine camel's hair brush.

MOUTH WASH.—Proof spirits 1 qt. borax and honey, of each 1 oz. gum myrrh 1 oz. red sanders wood 1 oz. Rub the honey and borax well together in a mortar, then gradually add the spirit, the myrrh and sanders wood and macerate 14 days.

CAMPBOR SOAPS.—Curd soap 28 lbs. otto of rosemary 1 $\frac{1}{2}$ lbs. Reduce the camphor to powder, add one ounce almond oil then sift it, when the soap is melted and ready to turn out, add the camphor and rosemary.

WHITE WINDSOR SOAP.—Curd soap 1 cwt. marine soap 21 lbs. oil soap 14 lbs. oil caraway, 1 $\frac{1}{2}$ lbs. oil thyme and rosemary of each $\frac{1}{2}$ lb. oils of cassia and cloves of each $\frac{1}{4}$ lb.

BROWN WINDSOR SOAP.—Curd soap $\frac{3}{4}$ cwt. marine soap $\frac{1}{4}$ cwt. yellow soap $\frac{1}{4}$ cwt. oil soap, $\frac{1}{4}$ cwt. Brown coloring (caramel) $\frac{1}{2}$ pt. oil caraway, cloves, thyme, cassia, petit grain and French lavender of each 2 oz.

SAND SOAP.—Curd soap 7 lbs. marine soap 7 lbs. sifted silver soap 28 lbs. oils thyme, cassia caraway and French lavender of each 2 oz.

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DROPSY.—SYRUP AND PILLS.—Queen-of-the-meadow root dwarf-elder flowers, berries, or inner bark, juniper berries, horse-radish root, pod milkweed, or silkweed, often called, root of each, 4 oz.: prickly-ash bark or berries, mandrake root, bittersweet bark, of the root of each, 2 oz.; white-mustard seed, 1 oz.; Holland gin, 1 pt. Pour boiling water upon all except the gin, and keep hot for 12 hours; then boil and pour off twice, and boil down to 3 qts., and strain, adding 3 lbs. of sugar, and lastly the gin. Dose, take all the stomach will bear, say a wine glass a day, or more.

DROPSY PILLS.—Jalap, 50 grs.; gamboge, 30 grs.; podophyllin, 20 grs.; clatarium, 12 grs.; aloes, 30 grs.; cayenne, 35 grs.; Castile soap, shaved and pulverized, 20 grs.; croton oil, 90 drops; powder all finely, and mix thoroughly; then form into pill mass, by using a thick mucilage made of equal parts of gum arabic and gum tragacanth, and divide in three-grain pills. Dose, 1 pill every 2 days for the first week; then every 3 or 4 days, until the water is evacuated by the combined aid of the pill with the alum syrup. This is a powerful medicine, and will thoroughly accomplish its work.

LIVER PILL.—Leptandrin, 40 grs.; podophyllin and cayenne, 30 grs. each; sanguinarin, iridin, and ipecac., 15 grs. each; see that all are pulverized and well mixed; then form into pill mass by using $\frac{1}{2}$ dr. of the soft extract of mandrake and a few drops of anise oil, then roll out into three-grain pills. Dose, 2 pills taken at bed-time will generally operate by morning; but some persons require 3.

IRRITATING PLASTER.—EXTENSIVELY USED BY ECLECTICS.—Tar, 1 lb.; burgundy pitch, $\frac{1}{2}$ oz.; white-pine turpentine, 1 oz.; resin, 2 oz. Boil the tar, resin, and gum together a short time, remove from the fire, and stir in finely pulverized mandrake root, blood root, poke root, and Indian turnip, of each, 1 oz.

PILLS.—TO SUGAR COAT.—Pills to be sugar coated must be very dry, otherwise they will shrink away from the coating, and leave it a shell easily crushed off. When they are dry, you will take starch, gum arabic, and white sugar, equal parts, rubbing them very fine in a marble mortar, and if damp, they must be dried before rubbing together; then put the powder into a suitable pan, or box, for shaking; now put a few pills into a small tin box having a cover, and pour on to them just a little simple syrup, shaking well to moisten the surface only; then throw into the box of powder, and keep in motion until completely coated, dry, and smooth.

If you are not very careful, you will get too much syrup upon the pills; if you do, put in more, and be quick about it to prevent moistening the pill too much, getting them into the powder as soon as possible.

POSITIVE CURE FOR HYDROPHOBIA.—The dried root of elecampane, pulverize it, and measure out 9 heaping tablespoonfuls, and mix it with 2 or 3 teaspoonfuls of pulverized gum arabic; then divide into 9 equal portions. When a person is bitten by a rabid animal, take one of these portions, and steep it in 1 pt. of new milk, until nearly half the quantity of milk is evaporated; then strain, and drink it in the morning, fasting for 4 or 5 hours after. The same

dose is to be repeated 3 mornings in succession, then skip 3, and so on, until the 9 doses are taken.

The patient must avoid getting wet, or the heat of the sun, and abstain from high-seasoned diet, or hard exercise, and, if costive, take a dose of salts. The above quantity is for an adult; children will take less according to age.

EYE PREPARATIONS.—EYE WATER.—Table salt and white vitriol, of each 1 tablespoon; heat them upon copper plates or in earthen ware until dry; the heating drives off the acrid water, called the water of crystallization, making them much milder in their action; now add to them soft water $\frac{1}{2}$ pt.; putting in white sugar, 1 tablespoon; blue vitriol, a piece the size of a common pea. If it should prove too strong in any case, add a little more soft water to a phial of it. Apply it to the eyes 3 or 4 times daily.

INDIA PRESCRIPTION FOR SORE EYES.—Sulphate of zinc, 3 grs.; tincture of opium (laudanum), 1 dr.; rose water, 2 oz.; mix. Put a drop or two in the eye, 2 or 3 times daily.

ANOTHER.—Sulphate of zinc, acetate of lead, and rock salt, of each $\frac{1}{2}$ oz.; loaf sugar, 1 oz.; soft water, 12 oz.; mix without heat, and use as other eye waters.

If sore eyes shed much water, put a little of the oxide of zinc into a phial of water, and use it rather freely. This will soon effect a cure.

Copperas and water has cured sore eyes of long standing; and used quite strong, it makes an excellent application in erysipelas.

INDIAN EYE WATER.—Soft water, 1 pt.; gum arabic, 1 oz.; white vitriol, 1 oz.; fine salt, $\frac{1}{2}$ teaspoon; put all into a bottle, and shake until dissolved. Put into the eye just as you retire to bed.

BLACK OIL.—Best alcohol, tincture of arnica, British oil, and oil of tar, of each 2 oz.; and slowly add sulphuric acid, $\frac{1}{2}$ oz.

These black oils are getting into extensive use as a liniment, and are indeed valuable, especially in cases attended with much inflammation.

VERMIFUGE LOZENGES.—Santonin 60 grs.; pulverized sugar, 5 oz.; mucilage of gum tragacanth, sufficient to make into a thick paste, worked carefully together, that the santonin shall be evenly mixed throughout the whole mass; then, if not in too great a hurry, cover up the mortar in which you have rubbed them, and let stand from 12 to 24 hours to temper; at which time they will roll out better than if done immediately; divide into 120 lozenges. Dose, for a child 1 year old, 1 lozenge, night and morning; of 2 years, 2 lozenges; of 4 years, 3; of 8 years, 4; of 10 years or more, 5 to 7 lozenges; in all cases, to be taken twice daily, and continuing until the worms start on a voyage of discovery.

HARLEM OIL OR WELSH MEDICAMENTUM.—Sublimed or flowers of sulphur and oil of amber, of each 2 oz.; linseed oil, 1 lb.; spirits of turpentine sufficient to reduce all to the consistence of thin molasses. Boil the sulphur in the linseed oil until it is dissolved, then add the oil of amber and turpentine. Dose, from 15 to 25 drops, morning and evening.

Amongst the Welsh and Germans it is extensively used for strengthening the stomach, kidneys, liver, and lungs; for asthma, shortness of breath, cough, inward or outward sores, dropay,

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worms, gravel, fevers, palpitation of the heart, giddiness, headache, &c., by taking it internally; and for ulcers, malignant sores, cankers, &c., anointing externally, and wetting linen with it, and applying to burns.

EGYPTIAN CURE FOR CHOLERA.—Best Jamaica ginger root, bruised, 1 oz.; cayenne, 2 teaspoons; boil all in 1 qt. of water to $\frac{1}{2}$ pt., and add loaf sugar to form a thick syrup. Dose, 1 tablespoon every 15 minutes, until vomiting and purging ceases; then follow up with a blackberry tea.

INDIAN PRESCRIPTION FOR CHOLERA.—First dissolve gum camphor, $\frac{1}{4}$ oz., in $1\frac{1}{2}$ oz. of alcohol; second, give a teaspoon of spirits of hartshorn in a wine glass of water, and follow it every 5 minutes with 15 drops of the camphor in a teaspoon of water, for 3 doses; then wait 15 minutes, and commence again as before; and continue the camphor for 30 minutes, unless there is returning heat. Should this be the case, give one more dose, and the cure is effected; let them perspire freely (which the medicine is designed to cause), as upon this the life depends, but add no additional clothing.

ISTHMUS CHOLERA TINCTURE.—Tincture of rhubarb, cayenne, opium, and spirits of camphor, with essence of peppermint, equal parts of each, and each as strong as can be made. Dose, from 5 to 30 drops, or even to 60, and repeat, until relief is obtained, every 5 to 30 minutes.

KING OF OILS, FOR NEURALGIA AND RHEUMATISM.—Burning fluid, 1 pt.; oils of cedar, hemlock, sassafras, and origanum, of each 2 oz.; carbonate of ammonia, pulverized, 1 oz.; mix. DIRECTIONS.—Apply freely to the nerve and gums around the tooth; and to the face, in neuralgic pains, by wetting brown paper and laying on the parts, not too long, for fear of blistering,—to the nerves of teeth by lint.

NEURALGIA.—INTERNAL REMEDY.—Sal-ammoniac, $\frac{1}{2}$ dr., dissolve in water 1 oz. Dose, one tablespoon every 3 minutes, for 20 minutes, at the end of which time, if not before, the pain will have disappeared.

ARTIFICIAL SKIN.—FOR BURNS, BRUISES, ABRASIONS, &c.—PROOF AGAINST WATER.—Take gun cotton and Venice turpentine, equal parts of each, and dissolve them in 20 times as much sulphuric ether, dissolving the cotton first, then adding the turpentine; keep it corked tightly. Water does not affect it, hence its value for cracked nipples, chapped hands, surface bruises, &c., &c.

INDIAN BALSAM.—Clear, pale rosin, 3 lbs., and melt it, adding spirits of turpentine, 1 qt., balsam of tolu, 1 oz.; balsam of fir, 4 oz.; oil of hemlock, origanum, with Venice turpentine, of each, 1 oz.; strained honey, 4 oz.; mix well, and bottle. Dose, 6 to 12 drops; for a child of six, 3 to 5 drops, on a little sugar. The dose can be varied according to the ability of the stomach to bear it, and the necessity of the case.

It is a valuable preparation for coughs, internal pains, or strains, and works benignly upon the kidneys.

WENS.—TO CURE.—Dissolve copperas in water to make it very strong; now take a pin, needle, or sharp knife, and prick, or cut the wen in about a dozen places, just sufficient to cause it to

bleed; then wet it thoroughly with the copperas water, once daily.

BRONCHOCLE.—ENLARGED NECK.—TO CURE.—Iodide of potassium (often called hydriodate of potash), 2 drs.; iodine, 1 dr.; water, 2½ oz.; mix and shake a few minutes, and pour a little into a phial for internal use. Dose, 5 to 10 drops before each meal, to be taken in a little water. **EXTERNAL APPLICATION.**—With a feather, wet the enlarged neck, from the other bottle, night and morning until well.

It will cause the scarf skin to peel off several times before the cure is perfect, leaving it tender, but do not omit the application more than one day at most, and you may rest assured of a cure, if a cure can be performed by any means whatever.

DALBY'S CARMINATIVE.—Magnesia, 2 drs.; oil peppermint, 3 drops; oil nutmeg, 7 drops; oil anise, 9 drops; tinct. of castor, 1½ drs.; tinct. of assafœtida, 45 drops; tinct. of opium, 18 drops; essence penny-royal, 50 drops; tinct. of cardamoms, 95 drops; peppermint water, 7 oz.; mix.

POSITIVE CURE FOR DIARRHŒA.—Take 2 wine glasses of vinegar, and one tablespoonful of salt. Mix the whole thoroughly to dissolve the salt. Add 7 to 10 drops of laudanum, according to the age or strength of the patient, and give the whole at one dose.

CURE FOR AGUE.—Cut three lemons into thin slices and pound them with a mallet, then take enough coffee to make a quart, boil it down to a pint and pour it while quite hot over the lemons. Let it stand till cold, then strain through a cloth, and take the whole at one dose, *immediately after the chill is over, and before the fever comes on.*

TO IMPROVE THE VOICE.—Bees wax, 2 drs.; copaiba balsam, 3 drs.; powder of liquorice root, 4 drs.; melt the copaiba balsam with the wax in a new earthen pipkin; when melted, remove them from the fire, and mix in the powder; make the pills of 3 grs. each. Two of these pills to be taken occasionally, 3 or 4 times a day. Very best known.

SIGNS OF DISEASE IN CHILDREN.—In the case of a baby not yet able to talk, it must *cry* when it is ill. The *colic* makes a baby cry loud, long, and passionately, and shed tears—stopping for a moment and beginning again.

If the chest is affected, it gives *one* sharp cry, breaking off immediately, as if crying hurt it.

If the head is affected, it cries, in *sharp, piercing shrieks*, with *low moans and wails between*. Or there may be quiet dozing, and startings between.

It is easy enough to perceive, where a child is attacked by disease, that there is some change taking place; for either its skin will be dry and hot, its appetite gone; it is stupidly sleepy, or fretful and crying; it is thirsty, or pale and languid, or in some way betrays that something is wrong. When a child vomits, or has a diarrhœa, or is costive and feverish, it is owing to some derangement, and needs attention. But these various symptoms may continue for a day or two before the nature of the disease can be determined. A warm bath, warm drinks, etc., can do no harm, and may help to determine the case. On coming out of the bath, and being well

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rubbed with the hand, the skin will show symptoms of rash, if it is a skin disease which has commenced. By the appearance of the rash, the nature of the disease can be learned. Measles are in patches, dark red, and come out first about the face. If scarlet fever is impending, the skin will look a deep pink all over the body, though most so about the neck and face. Chicken-pox shows fever, but not so much running at the nose, and appearances of cold, as in measles, nor is there as much of a cough. Besides, the spots are smaller, and do not run much together, and are more diffused over the whole surface of the skin; and enlarge into little blisters in a day or two.

Let the room where the child is sick be shady, quiet, and cool. Be careful not to speak so suddenly as to startle the half-sleeping patient, and handle it with the greatest tenderness when it is necessary to move it. If it is the lungs that suffer, have the little patient somewhat elevated upon the pillows for easier breathing, and do everything to soothe and make it comfortable, so as not to have it cry, and thus distress its inflamed lungs. If the child is very weak, do not move it too suddenly, as it may be startled into convulsions. In administering a bath, the greatest pains must be taken not to frighten the child. It should be put in so gradually, and so amused by something placed in the water on purpose as to forget its fear; keep up a good supply of fresh air, at a temperature of about 60° Fah. If a hired nurse *must* be had, select if possible a woman of intelligence, gentle and loving disposition, kind and amiable manners, and of a most pacific, unruffled, and even temper. If a being can be got possessed of these angelic qualities, and we believe there are many such, you will be quite safe in intrusting to her care the management of your sick child, or yourself either, in case of sickness. She should not be under twenty-five nor over fifty-five, as between these two ages she will, if healthy, be in her full strength and capacity.

HOOPING COUGH.—To empty the child's stomach by a lobelia emetic, is the first step. After this make a syrup of sugar, ginger-root, a little water, and enough lobelia tincture to produce a slight nausea. This, given two or three times a day, will loosen the cough very much. For croup remedy, see "Lock jaw cure," and "Croup cure."

DIARRHŒA.—Nothing is better for looseness of the bowels than tea made of ground bayberry. Sweeten it well, and give a half-teacupful once in two hours, until the child is better. Bathing must not be neglected.

COLIC.—This can be cured with warm injections, of simple soap-suds, or warm water with a warming tincture in it. A little warm tea may be given at the same time, and the bowels rubbed. Every family should have a small and large syringe. Nothing is oftener needed, particularly in the care of children.

FEVER.—Where a child has a simple fever from teething, or any other cause not connected with acute disease, give a teaspoonful of syrup of rhubarb, a warm injection, and sponge-baths. These will generally be all that is needed.

RICKETS and SCROFULA.—If children have either of these, or both these diseases, a good, nutritive diet is a great essential.

Then the alkaline-bath, a little lime-water, say a teaspoonful three times a day, and out-door exercise, are the chief remedies.

FITS—SPASMS—When these are brought on by indigestion, place the child in a warm bath immediately, give warm water, or a lobelia emetic, rub the skin briskly, etc., to get up an action. In brain disease the warm water is equally useful. In fact, unless the fit is constitutional, the warm bath will relieve the patient by drawing the blood to the surface.

ENLARGEMENT OF THE BRAIN.—This chiefly affects children, and consists in an unnatural growth of the brain. The skull may grow with it, and there be no symptoms of disease, though children with this large brain are apt to die of some brain disease. The symptoms of enlargement of the brain are, dullness of intellect, indifference to external objects, irritable temper, inordinate appetite, giddiness, and habitual headache. Sometimes there are convulsions, epileptic fits, and idiocy. There is also a peculiar projection of the parietal bones in this disease.

Treatment.—As much as possible, repress all exercise of the mind. Do not suffer the child to go to school; but put it to the most active and muscular exercise in the open air. The moment there is any heat in the top of the head, apply cold water, i. e., or cold evaporating lotions. The diet should be very simple, bread and milk only, if, as the child grows up, the signs of disease increase.

WATER IN THE HEAD.—Another disease of children, and especially of scrofulous children. It is inflammatory, and should be early noticed.

Symptoms.—Capricious appetite, a foul tongue, offensive breath, enlarged, and sometimes tender belly, torpid bowels, stools light-colored from having no bile, or dark from vitiated bile, fetid, sour-smelling, slimy and lumpy. The child grows pale and thin; and is heavy, languid, dejected; it is fretful, irritable, uneasy, and apt to be tottering in its gait.

The disease may begin, after these symptoms, by pains in the head, becoming more severe and frequent, sharp and shooting, causing the child to waken and shriek out. As the drowsy state advances, the shrieking gives place to moaning. There is great stiffness in the back of the neck, pain in the limbs, tenderness in the scalp, vomiting, sighing, intolerance of light, knitting of the brows, and increased disturbance of the stomach and bowels. This may last from ten to fourteen days, the patient growing more weak and peevish.

Another form of attack is marked by acute pain in the head, high fever, convulsions, flushed face, brilliant eyes, intolerance of light and sound, pain and tenderness in the belly, stupor, great irritability of stomach, causing retching and vomiting on every attempt to sit up.

The third mode of attack is very insidious—the early symptoms being so mild as hardly to be noticed. In this case, the convulsions or palsy come suddenly, without notice, bringing swift and unexpected destruction. In the first stage of the disease there is increased sensibility; in the second, decreased sensibility; in the

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third, palsy, convulsions, squinting of the eyes, rolling of the head, stupor, and a rapid, thread-like pulse.

Treatment.—In the first stage, purging is very important, and must be continued for three or four days. An excellent purgative is this: pulverized scammony, six grains; croton oil, four drops; pulverized loaf sugar, sixteen teaspoonfuls. Rub well together in a mortar. Give one teaspoonful every hour or two, till it operates. Apply cold water or ice to the head. In the second stage put blisters upon the back of the neck, and one on the bowels, if very tender. In the third stage use the warm bath, also alteratives and diuretics. For an alterative, use iodide of potassium, one dram; water, half an ounce; mix. Thirty drops to a child seven years old every hour. For a diuretic, use tincture of digitalis, one ounce; syrup of squills, one ounce; mix. Ten drops for a child seven years old every four hours. The patient should be kept in a dark room, away from all noise and excitement, and should lie upon a hair mattress, with his head somewhat elevated. The diet in the first stage should be nothing more than gruel; after that, more nourishing, but easy of digestion, such as beef-tea, plain chicken-broth, animal-jellies, etc. At the same time the patient should be supported by the cautious use of wine-whey, valerian, or ten drops of aromatic spirits of ammonia every four hours.

Mumps.—This disease, most common among children, begins with soreness and stiffness in the side of the neck. Soon a swelling of the paratoid gland takes place, which is painful and continues to increase for four or five days, sometimes making it difficult to swallow, or open the mouth. The swelling sometimes comes on one side at a time, but commonly upon both. There is often heat and sometimes fever, with a dry skin, quick pulse, furred tongue, constipated bowels, and scanty and high-colored urine. The disease is contagious.

Treatment.—Keep the face and neck warm, and avoid taking cold. Drink warm herb-teas, and if the symptoms are severe, 4 to 6 grs. of Dover's powder; or if there is costiveness, a slight physic, and observe a very simple diet. If the disease is aggravated by taking cold, and is very severe, or is translated to other glands, physic must be used freely, leeches applied to the swelling, or cooling lotions and poultices. Sweating must be resorted to in this case.

SCARLET FEVER is an acute inflammation of the skin, both external and internal, and connected with an infectious fever.

Symptoms.—The fever shows itself between two and ten days after exposure. On the second day of the fever the eruption comes out in minute pimples, which are either clustered together, or spread over the surface in a general *bright scarlet color*. The disease begins with languor, pains in the head, back, and limbs, drowsiness, nausea and chills, followed by heat and thirst. When the redness appears the pulse is quick, and the patient is restless, anxious and often delirious. The eyes are red, the face swollen, and the tongue covered in the middle with white mucus, through which are seen elevated points of extreme redness. The tonsils are swollen, and the throat is red. By the evening of the third or fourth day the

redness has reached its height, and the skin becomes moist, when the scarf-skin begins to come off in scales.

In this fever the flesh puffs up so as to distend the fingers, and disfigure the face. As it progresses the coating suddenly comes off the tongue, leaving it and the whole mouth raw and tender. The throat is very much swollen and inflamed, and ulcers form on the tonsils. The eustachian tube which extends up to the ear, the glands under the ear and jaw, sometimes inflame and break; and the abscesses formed in the ear frequently occasion deafness more or less difficult to cure. The symptoms of this disease may be distinguished from that of measles by the absence of cough; by the finer rash; by its scarlet color; by the rash appearing on the second instead of the fourth day; and by the ulceration of the throat.

Treatment.—In ordinary cases the treatment required is very simple. The room where the patient lies should be kept cool, and the bed-covering light. The whole body should be sponged with cool water as often as it becomes hot and dry, and cooling drinks should be administered. A few drops of belladonna, night and morning, is all that is needed.

If there is much fever and soreness of throat, give the following tincture of hellebore often enough to keep down the pulse:—

Tincture of American hellebore, 1 dr.; tincture of black cohosh, 2 oz.; mix. Take one teaspoonful 3 to 6 times a day.

It would also be useful to commence treatment with an emetic; and to soak the feet and hands in hot water containing a little mustard or cayenne pepper; continuing this bath 20 minutes, twice a day, for 2 or 3 days. The cold stage being passed, and the fever having set in, warm water may be used without the mustard or pepper. If the head is affected, put drafts upon the feet; and if the bowels be costive, give a mild physic. Solid food should not be allowed; but when the fever sets in, cooling drinks, such as lemonade, tamarind-water, rice-water, flaxseed tea, then gruel, or cold water may be given in reasonable quantities. To stimulate the skin, muriatic acid, 45 drops in a tumbler filled with water and sweetened, and given in doses of a teaspoonful, is a good remedy.

Where the disease is very violent, and the patient inclines to sink immediately; where typhoid symptoms appear and there is great prostration; the eruption strikes in; the skin changes to a mahogany color; the tongue is a deep red, or has on it a dark brown fur, and the ulcers in the throat become putrid, the treatment must be different from the above. In this case it must be *tonic*. Quinia must be given freely; and wine whey, mixed with toast-water, will be useful. Quinia is made as follows:—Sulphate of quinia, 1 scruple; alcohol, 4 ozs.; sulphuric acid, 5 drops; Madeira wine, 1 quart; mix. Two wine-glassfuls a day. Tincture of cayenne, in sweetened water, may be given in small doses. Gargles are also necessary. A good one is made of pulverized cayenne, 1 dram; salt, one dram; boiling water, 1 gill. Mix, and let them stand 15 minutes. Then add 1 gill vinegar. Let it stand an hour and strain. Put a teaspoonful in the child's mouth once in an hour. A warm bath should be used daily as soon as the

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skin begins to peel off, to prevent dropsy. If dropsy sets in, the bath once in 3 days is sufficient, and sweating should be promoted by giving the tincture of Virginia snake-root and similar articles; a generous diet should be allowed at the same time, to bring up the child's strength.

MEASLES is an acute inflammation of the skin, internal and external, combined with an infectious fever.

Symptoms. Chills succeeded by great heat, languor, and drowsiness, pains in the head, back and limbs, quick pulse, soreness of throat, thirst, nausea and vomiting, a dry cough, and high colored urine. These symptoms increase in violence for four days. The eyes are inflamed and weak, and the nose pours fourth a watery secretion, with frequent sneezing. There is considerable inflammation in the larynx, wind-pipe and bronchial tubes, with soreness of the breast and hoarseness. About the fourth day the skin is covered with a breaking out which produces heat and itching, and is red in spots, upon the face first, gradually spreading over the whole body. It goes off in the same way, from the face first and then from the body, and the hoarseness and other symptoms decline with it; at last the outside skin peels off in scales.

Treatment. In a mild form, nothing is required but a light diet, slightly acid drinks, and flaxseed or slippery elm tea. Warm herb teas, and frequent sponge baths with tepid water, serve to allay the fever; care should be taken not to let the patient take cold. If the fever is very high, and prevents the rash coming out, a slight dose of salts, or a nauseating dose of ipecac., lobelia, or hive-syrup should be given, and followed by teaspoonful doses of compound tincture of Virginia snake-root until the fever is allayed. If the patient from any derangement takes on a low typhoid type of fever, and the rash does not come out until the seventh day, and is then of a dark and livid color, tonics and stimulants must be given, and expectoration promoted by some suitable remedy. There is always danger of the lungs being left in an inflamed state after the measles, unless the greatest care is taken not to suffer the patient to take cold. Should there be much soreness or pain, and a severe cough, this must be treated as a separate disease, with other remedies.

Symptoms. **TYPHOID FEVER** is generally preceded by several days of languor, low spirits, and indisposition to exertion. There is also, usually, some pain in the back and head, loss of appetite, and drowsiness, though not rest. The disease shows itself by a chill. During the first week there is increased heat of the surface, frequent pulse, furred tongue, restlessness, sleeplessness, headache and pain in the back; sometimes diarrhoea and swelling of the belly, and sometimes nausea and vomiting.

The second week is often distinguished by small, rose-colored spots on the belly, and a crop of little watery pimples on the neck and chest, having the appearance of minute drops of sweat; the tongue is dry and black, or red and sore; the teeth are foul; there may be delirium, and dullness of hearing; and the symptoms every way are more serious than during the first week. Occasionally, the bowels are at this period perforated or ate through by ulceration, and the patient suddenly sinks. If the disease pro-

ceeds unfavorably into the third week, there is low, muttering delirium; great exhaustion; sliding down of the patient toward the foot of the bed; twitching of the muscles, bleeding from the bowels; and red or purple spots upon the skin.

If, on the other hand, the patient improves, the countenance brightens up, the pulse moderates, the tongue cleans, and the discharges look healthy.

Treatment. Give the patient good air, and frequent spongings with water, cold or tepid, as most agreeable. Keep the bowels in order, and be more afraid of diarrhoea than costiveness. Diarrhoea should be restrained by a little brandy, or by repeated doses of Dover's powder. For costiveness, give mild injections, made slightly loosening by castor oil, or common molasses. To keep down the fever, and produce perspiration, give tincture of veratrum viride, 10 drops every hour. If the bowels are swelled, relieve them by hot fomentations of hops and vinegar. If the pain in the head is very severe and constant, let the hair be cut short, and the head bathed frequently with cold water. Give light nourishment, and if the debility is great, broth and wine will be needed. Cleanse the mouth with very weak tea—old hyson. If the fever runs a low course, and the patient is very weak, quinine may be given from the beginning. Constant care and good nursing are very important.

Typhus fever is distinguished from typhoid by there being no marked disease of the bowels in typhus.

GROCERS AND CONFECTIONERS' RECEIPTS.

CHEAP VINEGAR.—Mix 25 gals. of warm rain water with 7 gals. molasses and 5 gals. yeast, and let it ferment, you will soon have the best of vinegar, keep adding these articles in these proportions as the stock is sold.

FOR GROCERS' SALES.—Take three barrels; let one of them be your vinegar barrel; fill this last up before it is quite empty, with molasses, 2 gals.; soft water, 11 gals.; yeast, 1 qt.; keeping these proportions in filling up the whole three barrels; sell the vinegar out of your old vinegar barrel as soon as it is ready, which will be in a short time; when nearly empty, fill it up with the fluid as before, and pass on to sell out of the next barrel; by the time it is disposed of go on to the last; then go back to the first, filling up your barrels in every case when nearly empty, and you will always keep a stock of good vinegar on hand unless your sales are very large; in which case, follow the next process. Have the bung-holes open in the barrels to admit air.

VINEGAR IN THREE DAYS.—Get a quantity of maple, beech, or basswood chips or shavings, and soak these in good vinegar for two or three days. With these chips you will fill a barrel, which has been pierced with a large number of inch holes all around the sides for the free admission of air among the chips (the more holes in the barrel the better, for the more air the sooner the vinegar

will be made below the top tub molasses barrels, in which vinegar even through the rel into the and then b from sugar molasses barrels, beer, ale, & being reduced beer as much you can also tioned below use 2 qts. y is slightly the shaving.

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will be made) ; cut another barrel in two halves, place one half below the barrel with the chips and the other half above it. The top tub must have its bottom pierced with a number of gimlet holes, in which are placed several threads of twine, to conduct the vinegar evenly over the chips. The liquid drains down slowly through the chips and out of a faucet near the bottom of the barrel into the lower tub. It should run through every four hours, and then be baled or pumped back. Directions to make vinegar from sugar : Use $1\frac{1}{2}$ lb. to each gal. of water ; of the dregs of molasses barrels, use 2 lbs. to each gal. water ; small beer, lager beer, ale, &c., which have become sour, make good vinegar by being reduced with water : small beer needs but little water, lager beer as much water as beer ; to 2 gals. cider add $\frac{1}{2}$ gal. of water ; you can also make excellent vinegar out of the artificial cider mentioned below. Use, in every case, soft water to make vinegar, and use 2 qts. yeast to every barrel. It makes much quicker if the fluid is slightly lukewarm. Leach either of these preparations through the shavings.

This process should be attended to during warm weather, or in a room where a pretty high temperature is kept up, as it will not work otherwise.

EXCELLENT VINEGAR, CHEAP.—Acetic acid, 5 lbs. ; molasses, 1 gal. ; yeast, 2 qts. ; put them into a forty-gal. cask, and fill it up with rain water ; stir it up, and let it stand one to three weeks, letting it have all the air possible, and you will have good vinegar. If wanted stronger, add more molasses. Should you at any time have weak vinegar on hand, put molasses into it to set it working. This will soon correct it.

WHITE WINE VINEGAR.—Mash up 20 lbs. raisins, and add 10 gals. water ; let it stand in a warm place for one month, and you will have pure white wine vinegar. The raisins may be used a second time the same way.

TO PRESERVE EGGS.—To each patent pailful of water, add 1 pt. of fresh slacked lime, and 1 pt. of common salt ; mix well. Fill your barrel half full with this fluid, put your eggs down in it any time after June, and they will keep two years if desired.

LIQUID MUCILAGE.—Fine clean glue, 1 lb. ; gum arabic, 10 oz. ; water, 1 qt. ; melt by heat in a glue kettle or water bath ; when entirely melted, add slowly 10 oz. strong nitric acid, set off to cool. Then bottle, adding a couple of cloves to each bottle.

BAKING POWDERS, very healthy.—Baking soda, 6 lbs. ; cream of tartar, 8 lbs. Dry each kind separately and thoroughly then mix all together and put up in damp proof packages, glass or tin is best, to be used in the proportion of 1 teaspoonful to each qt. of flour, mix up with cold water and put in the oven immediately.

CANDIED LEMON PEEL.—Take lemon peels and boil them in syrup ; then take them out, and dry.

TRANSPARENT SOAP.—Slice 6 lbs. nice yellow bar-soap into shavings ; put into a brass, tin or copper kettle, with alcohol, $\frac{1}{2}$ gal. heating gradually over a slow fire, stirring till all is dissolved ; then add 1 oz. sassafras essence, and stir until all is mixed ; now pour into pans about $1\frac{1}{2}$ inches deep, and when cold cut into square bars the length or width of the pan, as desired.

ENGLISH BAR-SOAP.—Six gals. soft water; 3 lbs. good stone lime; 20 lbs. sal-soda; 4 oz. borax; 15 lbs. fat (tallow is best); 10 lbs. pulverized resin, and 4 oz. bees'-wax; put the water in a kettle on the fire, and when nearly boiling add the lime and soda; when these are dissolved, add the borax; boil gently, and stir 'till all is dissolved; then add the fat, resin, and bees'-wax; boil all gently until it shows flaky on the stick, then pour into moulds.

BEST SOFT SOAP.—Mix 10 lbs. potash in 10 gals. warm soft water over night; in the morning boil it, adding 6 lbs. grease; then put all in a barrel, adding 15 gals. soft water.

SOAP WITHOUT LYE OR GREASE.—In a clean pot put $\frac{1}{2}$ lb. home-made hard or mush soap, and $\frac{1}{2}$ lb. sal-soda, and 5 pts. of soft water. Boil the mixture 15 minutes, and you will have 5 lbs. good soap for 7 $\frac{1}{2}$ cents.

HARD SOAP.—Take 5 lbs. hard soap, or 7 lbs. soft soap, and 4 lbs. sal-soda, and 2 oz. borax, and 1 oz. hartshorn; boil one quarter hour with 22 qts. water; add, to harden, $\frac{1}{2}$ lb. resin.

GERMAN YELLOW SOAP.—Tallow and sal-soda, of each 112 lbs., resin, 56 lbs.; stone lime, 28 lbs.; palm oil, 8 oz.; soft water, 28 gals. Put soda, lime, and water into a kettle and boil, stirring well; then let it settle, and pour off the lye. In another kettle, melt the tallow, resin, and palm oil; having it hot, the lye being also boiling hot, mix all together, stirring and the work is done.

FOR SMALL QUANTITIES.—Tallow and sal-soda, each, 1 lb.; resin, 7 oz.; stone lime, 4 oz.; palm oil, 1 oz.; soft water, 1 qt.

HARD SOAP WITH LARD.—Sal-soda and lard, each 6 lbs.; stone lime, 3 lbs.; soft water, 4 gals.; dissolve the lime and soda in the water by boiling, stirring, settling, and pouring off; then return to the kettle (brass or copper), and add the lard, and boil it till it becomes soap; then pour into a dish or moulds; and, when cold, cut into bars, and dry it.

WHITE HARD SOAP WITH TALLOW.—Fresh slacked lime, sal-soda, and tallow, of each, 2 lbs.; dissolve the soda in 1 gal. boiling soft water; now mix in the lime, stirring occasionally for a few hours; after which, let it settle, pouring off the clear liquor, and boiling the tallow therein until it is all dissolved; cool it in a flat box or pan, cut into bars or cakes as desired. It may be perfumed with sassafras oil or any other perfume desired, stirring it in when cool.

ONE HUNDRED POUNDS SOAP, VERY CHEAP.—Potash, 6 lbs.; lard, 4 lbs.; resin, $\frac{1}{2}$ lb. Beat up the resin, mix all together, and set aside for five days; then put the whole into a 10-gal. cask of water, and stir twice a day for ten days, when it is ready for use.

SOLID CANDLES FROM LARD.—Dissolve $\frac{1}{2}$ lb. alum and $\frac{1}{2}$ lb. sal-petre in $\frac{1}{2}$ pt. water on a slow fire; then take 3 lbs. of lard cut into small pieces, and put into the pot with this solution, stirring it constantly over a very moderate fire until the lard is all dissolved; then let it simmer until all steam ceases to rise and remove it at once from the fire. If you leave it too long it will get discolored. These candles are harder and better than tallow.

TALLOW—TO CLEANSE AND BLEACH.—Dissolve alum, 5 lbs. in water, 10 gals., by boiling; and when it is all dissolved, add tallow,

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20 lbs.; continue the boiling for an hour, constantly stirring and skimming; when sufficiently cool to allow it, strain through thick muslin; then set aside to harden; when taken from the water, lay it by for a short time to drip.

IMITATION WAX CANDLES.—Purify melted tallow by throwing in powdered quick lime, then add two parts wax to one of tallow, and a most beautiful article of candle, resembling wax, will be the result. Dip the wicks in lime water and saltpetre on making. To a gallon of water add 2 oz. saltpetre and $\frac{1}{2}$ lb. of lime; it improves the light, and prevents the tallow from running.

ADAMANTINE CANDLES FROM TALLOW.—Melt together 10 oz. mutton tallow; camphor, $\frac{1}{2}$ oz.; bees-wax, 4 oz.; alum, 2 oz. Very hard and durable, burning with a clear, steady light.

TEAS.—The names of the different kinds of tea relate to the time of their being gathered, or to some peculiarity in their manufacture. It is a general rule, that all tea is fine in proportion to the tenderness and immaturity of the leaves. The quality and value of the different kinds diminish as they are gathered later in the season.

BLACK TEAS.—As soon as the leaf-bud begins to expand, it is gathered to make *Pekoe*. A few days' later growth produces black leaved *Pekoe*. The next picking is called *Souchong*; as the leaves grow larger and more mature, they form *Cougou*; and the last picking is *Bohea*.

Bohea is called by the Chinese, *Ta-cha* (large tea), on account of the maturity and size of the leaves; it contains a larger proportion of woody fibre than other teas, and its infusion is of a darker color and coarser flavor.

Cougou, the next higher kind, is named from a corruption of the Chinese *Koong-fa* (great care, or assiduity). This forms the bulk of the black tea imported, and is mostly valued for its strength.

Souchong—*Seoa-choong* (small scarce sort), is the finest of the strongest black tea, with a leaf that is generally entire and curly. It is much esteemed for its fragrance and fine flavor.

Pekoe is a corruption of the Canton name, *Pak-ko* (white down), being the first sprouts of the leaf-buds; they are covered with a white silky down. It is a delicate tea, rather deficient in strength, and is principally used for flavoring other teas.

GREEN TEAS.—The following are the principal kinds *Twonkay*, *Hyson-Skin*, *Hyson*, *Gunpowder*, and *Young Hyson*.

Young Hyson is a delicate young leaf, called in the original language, *Yu-taien* (before the rains), because gathered in the early spring.

Hyson, from the Chinese word *He-tchune*, which means, flourishing spring. This fine tea is gathered early in the season, and prepared with great care and labor. Each leaf is picked separately, and nipped off above the footstalks; and every separate leaf is rolled in the hand. It is much esteemed for its flavor.

Gunpowder Tea is only *Hyson* rolled and rounded to give it the granular appearance whence it derives its name. The Chinese call it *Choo-cha* (pearl tea).

Hyson-Skin is so named from the Chinese term, in which connection *skin* means the refuse, or inferior portion. In preparing

Hyson, all leaves that are of a coarse yellow, or imperfectly twisted appearance, are separated, and sold as *skin-tea*, at an inferior price.

Twanky is the last picking of green tea, and the leaf is not rolled or twisted as much as the dearer descriptions. There is altogether less trouble bestowed on the preparation.

COFFEES.—JAVA COFFEE.—Use of the imported article, 20 lbs.; dried dandelion root, 7 lbs.; chicory, 13 lbs. Roast and grind well together.

FOR WEST INDIA, use rye roasted with a little butter, and ground very fine.

FOR TURKEY COFFEE, use rice or wheat roasted with a little butter, 7 lbs.; chicory, 3 lbs.; grind.

ESSENCE OF COFFEE is made by boiling down molasses till hard; grind to a powder; add $\frac{1}{2}$ lb. of good Java coffee to every 4 lbs. of the mixture. Put up for sale in round tin cans or air-tight paper packages.

COFFEE FOR POUND PACKAGES.—Best Java coffee, 1 lb.; rye, 3 lbs.; carefully clean the rye from all bad grains, wash to remove dust, drain off the water, and put the grain into your roaster, carefully stirring to brown it evenly. Brown the rye and coffee separately, grind, and put up in tight packages to preserve the aroma.

MANUFACTURING AND FLAVORING TOBACCO.—After the tobacco is properly cured and sweated, you will, preparatory to pressing, proceed to flavor it as follows: Take 1 oz. tonqua beans; 6 oz. liquorice, 1 lb. sugar; pulverize each completely; add the ingredients to 1 gallon water. Macerate and rummage up for a few days till the aromatic flavor is properly imparted to the liquid. Then spread out some tobacco leaves, and slightly sprinkle them with the above fluid till enough is absorbed to render them pliable. Then roll them up in round packages of such a size that ten will make 1 lb.; then reduce them into flat plugs in a powerful press. A large number of such plugs are subsequently pressed into blocks, when they are ready for the market at once. The strength of the above liquid may be increased or diluted as desired by the manufacturer, and extract of vanilla may be substituted for the tonqua bean.

FLAVOR FOR CIGAR MAKERS.—Take 2 ozs. tonqua beans and 1 oz. cinnamon; bruise and pulverize them to a powder, and put them into 1 pint of Santa Cruz rum; let it stand for a few days to macerate; stir all together, and with this liquid sprinkle your common or inferior tobacco. Dry out of the sun, and the flavor will be unequalled.

TO CURE BUTTER.—Take 2 parts of fine salt; 1 part loaf sugar; 1 part saltpetre; mix completely. Use 1 oz. of this mixture to each pound of butter; work well. Bury your butter firkins in the earth in your cellar bottom, tops nearly level with the ground, or store away in a very cool place, covering the butter with a clean cloth and a strong brine on the top, and it will keep two years if desired.

UNERGING TESTS FOR GOOD FLOUR.—Good flour is white, with a yellowish or straw-colored tint. Squeeze some of the flour in your hand; if good, it will retain the shape given by pressure.

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Knead a little between your fingers; if it works soft and sticky, it is poor. Throw a little against a dry perpendicular surface; if it fall like powder, it is bad.

TO CORRECT MUSTY FLOUR.—Carbonate of magnesia, 3 lbs.; flour, 765 lbs.; mix. This improves bad flour, causing it to become more wholesome, producing lighter and better bread than when alum is used, and absorbs and dissipates the musty smell.

AERATED BREAD.—1 lb. flour, 100 grs. carb. of soda; 60 grs. common salt; 1 teaspoon powdered sugar; 120 grs. muriatic acid, more or less according to its strength; 1 wine pt. of water, inferior flour will require less. Well mix the flour, soda, salt, and sugar in an earthen vessel, then add the acid mixed with the water, stir with a wooden spoon. Bake in one loaf about 1 hour. Bake in tin or iron pans, but avoid the use of metallic vessels or spoons while mixing.

PATENT SELF-RAISING FLOUR.—Kiln-dried flour, 1 cwt.; tartaric acid, 1½ oz.; mix thoroughly. After 2 or 3 days, add, of bicarb. soda, 12 oz.; lump sugar, ½ lb.; common salt, 1½ lb. Mix, and pass through the "dressing-machine." Have all the articles perfectly dry, and separately reduce to fine powder before adding to the flour. Mix with cold water, and bake at once. It produces light and porous bread.

TOMATO CATSUP.—Boil 1 bushel of tomatoes till they are soft; squeeze them through a fine wire sieve; add 1½ pts. salt, 2 oz. cayenne pepper, and 5 heads of onions, skinned and separated; mix together, and boil till reduced one half; then bottle.

THE NORTHERN-LIGHT BURNING FLUID.—Get good deodorized benzine, 60 to 65 gravity, and to each brl. of 42 gals. add 2 lbs. pulverized alum, 3½ oz. gum camphor, and 3½ oz. oil of sassafras, or 2 oz. oil bergamot; stir up and mix thoroughly together, and it will soon be ready for use. N.B.—As this fluid creates a much larger volume of light and flame than carbon oil, it is necessary to use either a high burner, such as the sun burner, to elevate the flame away from the lamp, in order to keep it cool, or instead thereof, to use a burner provided with a tube for the escape of the gas generated from the fluid, such, for instance, as the meridan burner.

TEST FOR BURNING OIL.—Heat water in a pot on the fire to 120° Fahr. Take a tin and put in it a tablespoonful of the oil you wish to test, place the tin containing the oil in the hot water, let it cool down to 112° Fahr.; when at this point, approach a light very cautiously towards the oil, and if it takes fire before the light touches it you will be safe in rejecting it.

TABAC PERFUMEE AUX FLEURS is made by putting orange flowers, jasmines, tube roses, musk roses, or common roses, to snuff in a close chest or jar, sifting them out after 24 hours, and repeating if necessary.

MACCABOY SNUFF is imitated by moistening the tobacco with a mixture of treacle and water, and allowing it to ferment.

SPANISH SNUFF is made from unsifted Havana snuff, reduced by adding ground *Spanish nutshells*, sprinkling the mixture with treacle water, and allowing it to sweat for some days before packing.

YELLOW SNUFF is prepared from ordinary *pale snuff*, moistened with a mixture of *yellow ochre* diffused in *water*, to which a few spoonfuls of thin *mucilage* has been added.

PERFUMES FOR SNUFF.—Tonqua beans, essence of ditto, ambergris, musk civet, leaves of orchis fusca and essence of orris root, essence or oils of bergamot, cedra, cloves, lavender, petit grain, neroli and roses, as well as several others, either alone or compounded.

PRESERVED OR SOLIDIFIED MILK.—1. Fresh-skimmed milk, 1 gal.; sesquicarbonate of soda (in powder), $1\frac{1}{2}$ dr. Mix; evaporate to $\frac{1}{2}$ part by heat of a steam or water-bath, with constant agitation; then add of powdered sugar $6\frac{1}{2}$ lbs. and complete the evaporation at a reduced temperature. Reduce the dry mass to powder, add the cream well drained, which was taken from the milk. After thorough admixture, put the whole into well-stopped bottles or tins, and hermetically seal. 2. Carbonate of soda, $\frac{1}{2}$ dr.; water, 1 fluid oz.; dissolve; add of fresh milk, 1 qt.; sugar, 1 lb.; reduce by heat to the consistence of a syrup, and finish the evaporation on plates by exposure, in an oven. *Observe*—About 1 oz. of the powder agitated with 1 pt. of water forms an agreeable substitute for milk.

SEALING-WAX, RED.—Shellac (very pale), 4 oz.; cautiously melt in a bright copper pan over a clear charcoal fire; when fused, add Venice turpentine, $1\frac{1}{2}$ oz. Mix, and further add vermilion, 3 oz.; remove the pan from the fire, and pour into mould. For a *black color*, use ivory black, or lampblack, instead of the vermilion; for a *blue color*, use Prussian blue instead of the vermilion, same quantity. Each color must be well mixed with the composition; if of the lampblack, use only sufficient to color.

HORTICULTURAL INK.—Copper, 1 part; dissolve in nitric acid, 10 parts, and add water, 10 parts; used to write on zinc or tin labels.

BOTTLE WAX—BLACK.—Black resin $6\frac{1}{2}$ lbs.; beeswax, $\frac{1}{2}$ lb.; finely powdered ivory black, $1\frac{1}{2}$ lbs. Melt together. **RED**, as the last, but substitute Venetian red, or red lead, for the ivory black.

GOLD-COLORED SEALING-WAX.—Bleached shellac, 3 lbs.; Venice turpentine, 1 lb.; Dutch leaf ground fine, 1 lb., or less. The leaf should be ground or powdered sufficiently fine, without being reduced to dust. Mix with a gentle heat, and pour into moulds.

LITHOGRAPHIC INK.—Venice turpentine 1 part, lampblack 2 parts, hard tallow soap 6 parts, mastic in tears, 8 parts, shellac 12 parts, wax 16 parts; melt, stir, and pour it out on a slab.

FINE BLACK WRITING INK.—To 2 gals. of a strong decoction of logwood, well strained, add $1\frac{1}{2}$ lbs. blue galls in coarse powder, 6 ozs. sulphate of iron, 1 oz. acetate of copper, 6 ozs. of well ground sugar, and 8 oz. gum arabic. Set the above on the fire until it begins to boil; strain, and then set it away until it has acquired the desired black.

GREEN INK.—Cream of tartar 1 part, verdigris 2 parts, 8 parts. Boil till reduced to the proper color.

BLUE INK.—Take sulphate of indigo, dilute it with water. it produces the required color.

VIOLET INK is made by dissolving some violet aniline in water to which some alcohol has been added; it takes very little aniline to make a large quantity of the ink.

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GOLD INK.—Mosaic gold, two parts, gum arabic, one part, rubbed up to a proper condition.

SILVER INK.—Triturate in a mortar equal parts of silver foil and sulphate of potassa, until reduced to a fine powder, then wash the salt out, and mix the residue with a mucilage of equal parts of gum arabic water.

FULLAM'S RECIPE FOR INDELIBLE STENCIL-PLATE INK.—1 lb. precipitate carbonate of iron; 1 lb. sulphate of iron; $1\frac{1}{2}$ lbs. acetic acid. Stir over a fire until they combine; then add 3 lbs. printer's varnish and 2 lbs. fine book ink, and stir until well mixed. Add 1 lb. of Ethiop's mineral.

EXCHEQUER INK.—Bruised galls, 40 lb.; gum, 10 lb.; green sulphate of iron, 9 lb.; soft water, 45 gal. Macerate for 3 weeks with frequent agitation and strain. This ink will endure for ages.

ASIATIC INK.—Bruised galls, 14 lb.; gum, 5 lb. Put them in a small cask, and add of boiling soft water, 15 gal. Allow the whole to macerate, with frequent agitation, for two weeks, then further add green copperas, 5 lb., dissolved in 7 pt. water. Again mix well, and agitate the whole daily for two or three weeks.

EXTRA GOOD BLACK INK.—Bruised galls, 2 lb., logwood chips, green copperas and gum, of each, 1 lb.; water, 7 gal. Boil 2 hours and strain. Product, 5 gal.

BROWN INK.—A strong decoction of catechu. The shade may be varied by the cautious addition of a little weak solution of bichromate of potash.

INDELIBLE INK.—Nitrate of silver, $\frac{1}{2}$ oz.; water, $\frac{1}{2}$ oz. Dissolve, add as much of the strongest liquor of ammonia as will dissolve the precipitate formed on its first addition; then add of mucilage $1\frac{1}{2}$ dr., and a little sap green, syrup of buckthorn, or finely powdered indigo, to color. Turns black on being held near the fire, or touched with a hot iron.

INDELIBLE INK FOR GLASS OR METAL.—Borax, 1 oz.; shellac, 2 oz.; water, 18 fluid oz.; boil in a covered vessel, add of thick mucilage, 1 oz.; triturate it with levigated indigo and lampblack q. s., to give it a good color. After 2 hours' repose, decant from the dregs and bottle for use. It may be bronzed after being applied. Resists moisture, chlorine, and acids.

COMMON INK.—To 1 gal. boiling soft water, add $\frac{1}{2}$ oz. extract logwood; boil two minutes; remove from the fire, and stir in 48 grains bichromate of potash, and 8 grains prussiate of potash; for 10 gal. use 6 $\frac{1}{2}$ oz. logwood extract; 1 oz. bichromate of potash, and 80 grains prussiate of potash; strain.

BLACK COPYING INK, OR WRITING FLUID.—Take 2 gal. rain water and put into it gum arabic, $\frac{1}{2}$ lb.; brown sugar, $\frac{1}{2}$ lb.; clean copperas, $\frac{1}{2}$ lb.; powdered nutgalls, $\frac{1}{2}$ lb.; mix, and shake occasionally for ten days and strain; if needed sooner, let it stand in an iron kettle until the strength is obtained. This ink will stand the action of the atmosphere for centuries, if required.

RED INK.—In an ounce phial put 1 teaspoonful of aqua-ammonia; gum arabic, size of two or three peas; and 6 grains of No. 40 carmine; fill up with soft water, and it is soon ready for use.

LIQUID BLACKING.—Ivory black, 2 lbs.; molasses, 2 lbs.; sweet oil, 1 lb.; rub together till well mixed; then add oil vitriol, $\frac{1}{2}$ lb.;

add coarse sugar, $\frac{1}{2}$ lb.; and dilute with beer bottoms; this cannot be excelled.

TICKETING INK FOR GROCERS, &c.—Dissolve 1 oz. of gum arabia in 6 oz. water, and strain; this is the mucilage; for *black color*, use drop-black, powdered, and ground with the mucilage to extreme fineness; for *blue*, ultra-marine is used in the same manner; for *green*, emerald green; for *white*, flake white; for *red*, vermilion, lake, or carmine; for *yellow*, chrome yellow. When ground too thick, they are thinned with a little water. Apply to the cards with a small brush. The cords may be sized with a thin glue, and afterwards varnished, if it is desired to preserve them.

BLUING FOR CLOTHES.—Take 1 oz. of soft Prussian blue, powder it, and put in a bottle with 1 quart of clear rain water, and add $\frac{1}{2}$ oz. of pulverized oxalic acid. A tablespoonful is sufficient for a large washing.

PREMIUM METHOD OF KEEPING HAMS, &c.—To 4 gal. water, add 8 lbs. coarse salt; $\frac{1}{2}$ oz. potash; 2 oz. saltpetre; 2 lbs. brown sugar. Boil together, skim when cold, put on the above quantity to 100 lbs. meat; hams to remain in eight weeks, beef, three weeks. Let the hams dry several days before smoking. Meat of all kinds, salmon and other fish, lobsters, &c., may be preserved for years by a light application of pyroligneous acid applied with a brush, sealing up in cans as usual. It imparts a splendid flavor to the meat, is very cheap, and an effectual preservative against loss.

TO PRESERVE MEATS, SALMON, LOBSTERS, &c., HERMETICALLY SEALED.—The meat to be preserved is first parboiled or somewhat more, and freed from bones. It is then put into tin cases or canisters, which are quite filled up with a rich gravy. A tin cover, with a small aperture, is then carefully fixed on by solder; and, while the vessel is perfectly full, it is placed in boiling water, and undergoes the remainder of the cooking. The small hole in the cover is completely closed up by soldering while the whole is yet hot. The canister, with its ingredients, is now allowed to cool, in consequence of which these contract, and the sides of the vessel are slightly forced inward by atmospheric pressure, and become a little concave. The vessel being thus hermetically sealed, and all access of air prevented, it may be sent into any climate without fear of putrefaction; and the most delicate food of one country may be used in another in all its original perfection months and years after its preparation. Lobsters should be boiled longer than meats, and the scales removed previous to putting into the canisters. Salmon put up by this process is most delicious. By the French process, the meat is boiled till it is three-quarters done, when two-thirds of it are taken out, the remaining one-third is boiled into a concentrated soup, and the meat previously taken out is put into the canisters, which are then filled up with the soup; the tin cover with aperture is soldered on, and the canister with its contents submitted to a further boiling in hot water, when the aperture is closed, as above stated, and the canisters laid away in store.

TO PRESERVE FRUITS WITHOUT SUGAR.—Fill some stone wide-mouthed bottles with the fruit carefully picked, and set them in a copper or large kettle; then fill the kettle with cold water nearly

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up to the months of the bottles. Corks should be prepared to fit the bottles, and a cloth should be put under the bottoms of the bottles to prevent their cracking with the heat. Light the fire under the kettle, and heat the water to 160° or 170°. This heat should be continued for half an hour, when the fruit will be sufficiently scalded; after that, fill up the bottles with boiling water to within an inch of the cork, and cork them tightly. Lay the bottles on their sides; change the position of the bottles once or twice a week during the first two months, turning them round to prevent any fermentation that might take place. Fruits could also be kept by the process mentioned above for meats, remembering that they are to be scalded only, not boiled, as is the case with meats.

ANOTHER METHOD.—After paring and coring, put amongst them sufficient sugar to make them palatable for present eating, about 3 or 4 lbs. only to each bushel; let them stand awhile to dissolve the sugar, not using any water; then heat to a boil, and continue the boiling with care for 20 to 30 minutes, or sufficiently long to heat them through, which expels the air. Have ready a kettle of hot water, into which dip the can or bottle long enough to heat it; then fill in the fruit while hot, corking it immediately, dipping the end of the cork into the bottle-wax preparation described elsewhere.

WORCESTERSHIRE SAUCE.—Port wine and mushroom ketchup, of each 1 qt.; old ale and strong vinegar, of each, $\frac{1}{2}$ pt.; walnut pickle, 1 pt.; soy, $\frac{1}{2}$ pt.; pounded anchovies, $\frac{1}{2}$ lb.; fresh lemon peel, minced shallots, and scraped horse-radish, of each, 2 oz.; allspice and black pepper (bruised), of each, 1 oz.; curry powder, 2 oz. Digest 14 days; strain and bottle.

GHERKINS.—Take small cucumbers (not young), steep for a week in very strong brine; it is then poured off, heated to the boiling point, and again poured on the fruit. The next day, the gherkins are drained on a sieve, wiped dry, put into bottles or jars, with some spice, ginger, pepper, or cayenne, and at once covered with strong pickling vinegar.

MIXED PICKLES from cauliflowers, white cabbage, French beans, onions, cucumbers, &c., are treated as *gherkins*, with raw ginger, capsicum, mustard-seed, and long pepper, added to each bottle. A little coarsely-bruised turmeric improves both the color and flavor.

INDIAN PICKLE.—*Piccalilli.*—Take one hard white cabbage (sliced), 2 cauliflowers, pulled to pieces, 20 French beans, 1 stick of horse-radish, sliced fine, 2 doz. small white onions, and 1 doz. gherkins. Cover these with boiling brine; next day, drain the whole on a sieve, put it into a jar, add of curry powder, or turmeric, 2 oz.; garlic, ginger, and mustard-seed, of each 1 oz.; capsicum, $\frac{1}{2}$ oz. Fill up the vessel with hot pickling vinegar; bung it up close, and let it stand for a month, with occasional agitation every week.

TO PRESERVE FRUIT JUICE WITHOUT HEAT.—Ingredients: 10 lbs. of fresh-gathered, picked, ripe red currants, or other fruit, 2 qts. cold water, 5 oz. tartaric acid, 6 lbs. of coarse-sifted sugar. Put the fruit into a large earthen pan, pour the water with the tartaric acid dissolved in it over the fruit, cover the pan with some kind of

lid, and allow the whole to steep for 24 hours in a cold place, and it would be all the better if the pan containing the fruit could be immersed in rough ice. Next, pour the steeped fruit into a suspended stout flannel bag, and when all the juice has run through, tie up the open end of the bag, and place it on a large earthen dish, with another dish upon it; place a half-hundred weight upon this, to press out all the remaining juice, and then mix it with the other juice. You now put the sifted sugar into the juice, and stir both together occasionally, until the sugar is dissolved, and then bottle up the syrup, cork, and tie down the bottles with wire, and keep them in the ice well or in a cold cellar, in a reclining position.

TO RESTORE INJURED MEAT.—When the brine sours and taints the meat, pour it off; boil it, skim it well, then pour it back again on the meat boiling hot; this will restore it, even when much injured. If tainted meat is injured, dip it in the solution of chloride of lime prescribed for rancid butter; it will restore it. Fly-blown meat can be completely restored by immersing it for a few hours in a vessel containing a small quantity of beer; but it will taint and impart a putrid smell to the liquor. Fresh meat, hams, fish, &c., can be preserved for an indefinite length of time without salt, by a light application of pyroligneous acid applied with a brush; it imparts a fine smoky flavor to the meat, and is an effectual preservative. But pure acetic acid may be used instead.

METHOD OF CURING BAD TUB BUTTER.—A quantity of tub-butter was brought to market in the West Indies, which, on opening, was found to be very bad, and almost stinking. A native of Pennsylvania undertook to cure it, which he did in the following manner:—

He started the tubs of butter in a large quantity of hot water, which soon melted the butter; he then skimmed it off as clean as possible, and worked it over again in a churn, and, with the addition of salt and fine sugar, the butter was sweet.

TO RESTORE RANCID BUTTER.—Use 1 pt. water to each lb. of butter, previously adding 20 grs. chloride of lime to each pt. of water; wash well the butter in this mixture, afterward re-wash in cold water and salt; or melt the butter in a water bath with animal charcoal, coarsely powdered and previously well sifted to free it from dust; skim, remove, and strain through flannel; then salt.

FRESH MEAT—TO KEEP A WEEK OR TWO IN SUMMER.—Farmers or others living at a distance from butchers can keep fresh meat very nicely for a week or two, by putting it into sour milk, or butter milk, placing it in a cool cellar. The bone or fat need not be removed. Rinse well when used.

MILKMAN'S PROCESS.—To give a body to diluted milk use the following nutritive and healthy compound at the rate of 8 oz. to every 5 gals., stirring it up in the milk, till all is dissolved: arrow-root, 6 oz.; magnesia, 6 oz.; starch, 1 lb.; flour, $\frac{1}{2}$ lb.; white sugar in powder, 1 lb.; mix all intimately together, and keep in a dry place for use.

CUSTARD POWDERS.—Sago meal and flour, 1 lb. each, color with turmeric to a cream color. Flavor with essential oil of almonds, 1 dr.; ess. of lemon, 2 drs. Use with sweetened milk to form extemporaneous custards.

RAPID PROFIT.—Retail great man and caps, in buying, these hats unless he determine make a living, his good time to make therefore he afraid to buy he may have It then be instantly with certain profit of 20

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RAPID PROCESS OF MARKING GOODS AT ANY DESIRED PER CENT. PROFIT.—Retail merchants, in buying goods by wholesale, buy a great many articles by the dozen, such as boots and shoes, hats and caps, and notions of various kinds, now, the merchant, in buying, for instance, a dozen hats, knows exactly what one of these hats will retail for in the market where he deals; and, unless he is a good accountant it will often take him some time to determine whether he can afford to purchase the dozen hats and make a living profit in selling them by the single hat; and in buying his goods by auction, as the merchant often does, he has not time to make the calculation before the goods are bid off. He therefore loses the chance of making good bargains by being afraid to bid at random, or if he bids, and the goods are cried off, he may have made a poor bargain, by bidding thus at a venture. It then becomes a useful and practical problem to determine *instantly* what per cent. he would gain if he retailed the hat at a certain price, to tell what an article should retail for to make a profit of 20 per cent.

RULE.—*Divide what the articles cost per dozen by 10, which is done by removing the decimal point one place to the left.*

For instance, if hats cost \$17.50 per dozen, remove the decimal point one place to the left, making \$1.75, what they should be sold for apiece to gain 20 per cent on the cost. If they cost \$31.00 per dozen, they should be sold at \$3.10 apiece, etc. We take 20 per cent. as the basis for the following reasons, viz.: because we can determine instantly, by simply removing the decimal point, without changing a figure, and, if the goods would not bring at least 20 per cent. profit in the home market, the merchant could not afford to purchase, and would look for cheaper goods.

The reason for the above rule is obvious, for if we divide the cost of a dozen by 12, we have the cost of a single article; then if we wish to make 20 per cent. on the cost (cost being 1-1 or 5-5), we add the per cent., which is 1-5, to the 5 5, making 6-5 or 12-10; then as we multiply the cost, divided by 12, by the 12-10 to find at what price one must be sold to gain 20 per cent., it is evident that the 12s will cancel and leave the cost of a dozen to be divided by 10, to do this remove the decimal point one place to the left.

EXAMPLE 1.—If I buy 2 dozen caps at \$7.50 per dozen, what shall I retail them at to make 20 per cent.? Ans. 75 cents.

EXAMPLE 2.—When a merchant retails a vest at \$4.50 and makes 20 per cent., what did he pay per doz.? Ans. \$45.

EXAMPLE 3.—At what price should I retail a pair of boots that cost \$85.00 per doz. to make 20 per cent.? Ans. \$8.50.

Now, as removing the decimal point one place to the left, on the cost of a dozen articles, gives the selling price of a single one with 20 per cent. added to the cost, and, as the cost of any article is 100 per cent., it is obvious that the selling price would be 20 per cent. more, or 120 per cent.; hence, to find 50 per cent. profit which would make the selling price 150 per cent., we would first find 130 per cent. then add 30 per cent. by increasing it one-fourth itself; to make 40 per cent. add 20 per cent. by increasing it one-sixth itself; for 35 per cent., increase it one-eighth itself, etc. Hence to mark an article at any per cent. profit we find the following,

GENERAL RULE.—First find 20 per cent. profit by removing the decimal point one place to the left on the price the articles cost per doz. then, as 20 per cent. profit is 120 per cent. add to or subtract from this amount the fractional part that the required per cent. added to 100 is more or less than 120

Merchants, in marking goods, generally take a per cent. that is an aliquot part of 100, as 25, 33 1-3, 50, &c. The reason they do this is because it makes it much easier to add such a per cent. to the cost; for instance, a merchant could mark almost a dozen articles at 50 per cent. profit in the time it would take him to mark one at 49 per cent. The following table is arranged for the convenience of business men in marking the prices of all articles bought by the dozen.

To make 20 per cent. remove the point one place to the left.	
" 80 " " " " and add $\frac{1}{2}$ itself.	
" 60 " " " " " " 1-3 "	
" 50 " " " " " " 1-4 "	
" 44 " " " " " " 1-5 "	
" 40 " " " " " " 1-6 "	
" 37 " " " " " " 1-7 "	
" 35 " " " " " " 1-8 "	
" 33 1-3 " " " " " " 1-9 "	
" 32 " " " " " " 1-10 "	
" 30 " " " " " " 1-12 "	
" 28 " " " " " " 1-15 "	
" 26 " " " " " " 1-20 "	
" 25 " " " " " " 1-24 "	
" 12 $\frac{1}{2}$ " " " " " subtract 1-16 "	
" 16 2-3 " " " " " " 1-36 "	
" 18 $\frac{1}{3}$ " " " " " " 1-96 "	

If I buy a doz. shirts for \$28.00, what shall I retail them for to make 50 per cent. ? Ans. \$35.00.

EXPLANATION.—Remove the point one place to the left, and add $\frac{1}{2}$ itself.

ALIUOT PARTS OF 100 AND 1000.—Merchants in selling goods generally make the price of an article some aliquot part of 100, as in selling sugar at 12 $\frac{1}{2}$ cents per lb., or 8 lbs. for \$1.00, or in selling calico for 16 2-3 cents per yard, or 6 yds. for \$1.00, etc. The following table will be found valuable for all such calculations.

12 $\frac{1}{2}$ is 1-8 part of 100.	8 $\frac{1}{3}$ is 1-12 part of 100.
25 is 1-4 part of 100.	16 2-3 is 2-12 or 1-6 of 100.
37 $\frac{1}{2}$ is 3-8 part of 100.	33 1-3 is 4-12 or 1-3 of 100.
50 is 4-8 or $\frac{1}{2}$ of 100.	66 2-3 is 8-12 or 2-3 of 100.
62 $\frac{1}{2}$ is 5-8 part of 100.	83 1-3 is 10-12 or 5-6 of 100.
75 is 6-8 or 3-4 of 100.	125 is 1-8 part of 1000.
87 $\frac{1}{2}$ is 7-8 part of 100.	250 is 2-8 or $\frac{1}{4}$ of 1000.
6 $\frac{1}{4}$ is 1-16 part of 100.	375 is 3-8 part of 1000.
18 $\frac{1}{3}$ is 2-16 part of 100.	625 is 5-8 part of 1000.
31 $\frac{1}{3}$ is 5-16 part of 100.	875 is 7-8 part of 1000.

To multiply by an aliquot part of 100.

REMARK.—A 1 two figures is the multiplier, then take such part of it as the multiplier is part of 100.

N. B. If the multiplicand is a mixed number reduce the fraction to a decimal of two places before dividing

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CURRY POWDER.—Turmeric and coriander seeds, of each, 4 oz.; black pepper, 2½ oz.; ginger, 14 drs.; cinnamon, mace, and cloves, each, ½ oz.; cardamom seeds, 1 oz.; cummin seeds, 2 drs.; cayenne pepper, 1 oz.; powder and mix.

NAPOLEON'S CAMP SAUCE.—Old strong beer, 2 qts., white wine, 1 qt., anchovies 4 ounces: mix; boil for ten minutes; remove it from the fire, and add of peeled shallots, 3 ounces; macerate for 14 days, and bottle.

PICKLED ONIONS.—Choose small round onions, remove the skins, steep them in strong brine for a week in a stone vessel, pour it off, and heat till it boils; then pour on the onions, boiling hot; after 24 hours, drain on a sieve, then put them in bottles, fill up over them with strong spiced vinegar, boiling hot, cork down immediately, and wax over the cork. In a similar manner are pickled mushrooms, cauliflowers, samphires, peas, beans, green gooseberries, walnuts, red cabbages (without salt, with cold vinegar). Observe that the soft and more delicate articles do not require so long soaking in brine as the harder and coarser kinds, and may be often kept by simply pouring very strong pickling vinegar on them without the application of heat. For peaches, select ripe but not soft ones; rub with a dry cloth; put four cloves, free from their heads, in each large peach, and two in small ones; to one gallon vinegar, put 6 lb. good brown sugar; put the peaches in a jar, and put the vinegar (diluted with water, if too strong) and sugar in a preserving kettle over the fire; boil and skim it; pour it boiling hot over the peaches, covering them closely; repeat the operation three times; then seal them tightly in cans or bottles.

FRENCH PATENT MUSTARD.—Flour of mustard, 8 lbs.; wheaten flour, 8 lbs.; bay salt, 2 lbs.; cayenne pepper, 4 oz.; vinegar to mix.

COMMON MUSTARD.—Flour of mustard, 28 lbs.; wheat flour, 28 lbs.; cayenne pepper, 12 oz., or as required; common salt, 10 lbs.; rape oil, 3 lbs.; turmeric to color; mix well, and pass through a fine sieve.

STARCH POLISH.—White wax, 1 oz.; spermaceti, 2 oz.; melt them together with a gentle heat. When you have prepared a sufficient amount of starch, in the usual way, for a dozen pieces, put into it a piece of the polish the size of a large pea; more or less, according to large or small washings. Or thick gum solution (made by pouring boiling water upon gum arabic), one tablespoon to a pint of starch, gives clothes a beautiful gloss.

FIRE KINDLERS.—To make very nice fire kindlers, take resin, any quantity, and melt it, putting in for each pound being used, from 2 to 3 oz. of tallow, and when all is hot, stir in pine sawdust to make very thick; and, while yet hot, spread it out about 1 inch thick, upon boards which have fine sawdust sprinkled upon them, to prevent it from sticking. When cold, break up into lumps about 1 inch square. But if for sale, take a thin board and press upon it, while yet warm, to lay it off into 1 inch squares: this makes it break regularly, if you press the crease sufficiently deep, greasing the marked board to prevent it from sticking.

TO KEEP CIDER SWEET, AND SWEETEN SOUR CIDER.—To keep cider perfect, take a keg and bore holes in the bottom of it; spread a

piece of woollen cloth at the bottom; then fill with clean sand closely packed; draw your cider from a barrel just as fast as it will run through the sand; after this, put it in clean barrels which have had a piece of cotton or linen cloth 2 by 7 inches dipped in melted sulphur and burned inside of them, thereby absorbing the sulphur fumes (this process will also sweeten sour cider); then keep it in a cellar or room where there is no fire, and add $\frac{1}{2}$ lb. white mustard seed to each barrel. If cider is long made, or souring when you get it, about 1 qt. of hickory ashes (or a little more of other hard wood ashes) stirred into each barrel will sweeten and clarify it nearly equal to rectifying it as above; but if it is not rectified, it must be racked off to get clear of the pomace, as with this in it, it will sour. Oil or whisky barrels are best to put cider in, or $\frac{1}{2}$ pint sweet oil to a barrel, or a gallon of whisky to a barrel, or both, may be added, with decidedly good effects; isinglass, 4 oz. to each barrel, helps to clarify and settle cider that is not going to be rectified.

GINGER WINE.—Water, 10 gals., lump sugar, 20 lbs., bruised ginger, 8 oz.; 1 or 4 eggs. Boil well and skim; then pour hot on six or seven lemons cut in slices, macerate for 2 hours; then rack and ferment; next add spirit, 2 qts., and afterwards finings, 1 pint; rummage well. To make the color, boil $\frac{1}{2}$ oz. saleratus and $\frac{1}{2}$ oz. alum in 1 pint of water till you get a bright red color.

ICE CREAM.—Have rich, sweet cream, and a half-pound of loaf sugar to each quart of cream or milk. If you cannot get cream, the best imitation is to boil a soft custard, 2 eggs to each quart of milk (eggs well beat). Or another is made as follows: boil 1 quart of milk, and stir into it, while boiling, 1 tablespoonful of arrowroot wet with cold milk; when cool, stir into it the yolk of 1 egg to give it a rich color. Five minutes' boiling is enough for either plan. Put the sugar in after they cool; keep the same proportions for any amount desired. Or thus: to 6 quarts of milk add $\frac{1}{2}$ lb. Oswego starch, first dissolved; put the starch in 1 quart of the milk; then mix altogether, and simmer a little (not boil); sweeten and flavor to your taste; excellent. The juice of strawberries or raspberries gives a beautiful color and flavor to ice creams, or about $\frac{1}{2}$ ounce essence or extract to 1 gallon, or to suit the taste. Have your ice well broken, 1 qt. salt to a bucket of ice. About one half hour's constant stirring, with occasional scraping down and beating together, will freeze it.

SUBSTITUTE FOR CREAM.—Take 2 or 3 whole eggs, beat them well up in a basin; then pour boiling hot tea over them; pour gradually to prevent curdling: It is difficult for the taste to distinguish it from rich cream.

CHICAGO ICE CREAM.—Irish moss soaked in warm water one hour, and rinsed well to cleanse it of sand and a certain foreign taste; then steep it in milk, keeping it just at the point of boiling or simmering for one hour, or until a rich yellow color is given to the milk; without cream or eggs, from 1 to 1 $\frac{1}{2}$ oz. to a gal. only is necessary, and this will do to steep twice. Sweeten and flavor like other creams.

GINGER BEER.—Take 5 $\frac{1}{2}$ gals. water, $\frac{3}{4}$ lb. ginger root bruised, tartaric acid, $\frac{1}{2}$ oz., white sugar, 2 $\frac{1}{2}$ lbs., whites of 3 eggs well beaten, 10 small teaspoonfuls of lemon ess.; yeast, 1 gill; boil the

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root for 30 minutes in 1 gal. of the water; strain off and put the ess. in while hot; mix, make over night; in the morning, skim and bottle, keeping out the sediments.

PHILADELPHIA BEER.—Take 30 gals. water, brown sugar, 20 lbs. ginger root bruised, $\frac{1}{2}$ lb., cream of tartar, $\frac{1}{4}$ lbs., carbonate of soda, 3 oz., oil of lemon, cut in a little alcohol, 1 teaspoonful, the white of 10 eggs well beaten, hops, 2 oz., yeast, 1 qt. The ginger root and hops should be boiled for twenty or thirty minutes in enough of the water to make all milk-warm; then strained into the rest and the yeast added and allowed to work itself clear; then bottle.

CIDER WITHOUT APPLES.—Water, 1 gallon; common sugar, 1 lb.; tartaric acid, $\frac{1}{2}$ oz.; yeast, one tablespoonful; shake well, make in the evening, and it will be fit to use next day.

FOR BOTTLING.—Put in a barrel, 5 gals. hot water; 30 lbs. common sugar; $\frac{1}{2}$ lb. tartaric acid; 25 gallons cold water; 3 pints of hop or brewers' yeast, worked into paste with 1 pint water and 1 lb. flour. Let it work in the barrel forty-eight hours, the yeast running out of the bung-hole all the time, putting in a little sweetened water occasionally to keep it full; then bottle, putting in two or three broken raisins to each bottle; and it will nearly equal champagne.

CHEAP CIDER.—Put in a cask 5 gals. hot water; 15 lbs. brown sugar; 1 gal. molasses; $\frac{1}{2}$ gal. hop or brewers' yeast; good vinegar, 6 qts.; stir well, add 25 gals. cold water, ferment as the last.

ANOTHER CIDER.—Cold water, 20 gals., brown sugar, 15 lbs., tartaric acid, $\frac{1}{2}$ lb.; rummage well together, and add, if you have them, 3 or 4 lbs. of dried sour apples, or boil them and pour in the expressed juice. This cider will keep longer than the others.

SPRUCE AND GINGER BEER.—Cold water, 10 gals.; boiling water, 11 gals.; mix in a barrel; add molasses, 30 lbs., or brown sugar, 24 lbs.; oil of spruce or any oil of which you wish the flavor, 1 oz.; add 1 pint yeast, ferment, bottle in two or three days. If you wish white spruce beer, use lump sugar; for ginger flavor, use 17 oz. ginger root bruised, and a few hops; boil for thirty minutes in three gals. of the water, strain and mix well; let it stand two hours and bottle, using yeast, of course, as before.

HOP BEER, VERY FINE.—Mix 14 lbs. molasses and 11 gals. water well together, and boil them for 2 hours with 6 oz. hops. When quite cool, add a cupful of yeast, and stir it well by a gallon or two at a time. Let it ferment for 16 hours, in a tub covered with a sack, then put it into a 9-gallon cask, and keep it filled up; bung it down in 2 days, and in 7 days it will be fit to drink, and will be stronger than London porter.

EDINBURGH ALE.—Employ the best pale malt—1st, mash 2 barrels per quarter, at 183°, mash three-quarters of an hour, let it stand 1 hour, and allow half an hour to run off the wort; 2d, mash 1 barrel per quarter, at 180°, mash three-fourths of an hour, let it stand three-fourths, and tap as before; 3d, mash 1 barrel per quarter, at 170°, mash half an hour, let it stand half an hour, and tap as before. The first and second wort may be mixed together, boiling them about an hour or an hour and a quarter, with a quantity of hops proportioned to the time the ale is required to be kept. The

first two may be mixed at the heat of 60°, in the gyletun, and the second should be fermented separately for small beer. The best hops should be used in the proportion of about 4 lbs. for every quarter of malt employed.

BOTTLED PORTER.—Brown Stout. Pale malt, 2 quarters; amber and brown malt, of each 1½ do.; mash at 3 times, with 12, 7, and 6 barrels of water; boil with hops, 50 lbs., set with yeast, 29 lbs. Product, 17 barrels, or 1½ times the malt.

LEMON BEER.—To make 20 gals., boil 6 oz. of ginger root bruised, $\frac{1}{4}$ lb. cream of tartar, for 20 or 30 minutes, in 2 or 3 gals. water. This will be strained in 13 lbs. coffee sugar, on which you have put $\frac{1}{2}$ oz. oil of lemon, and six good lemons squeezed up together, having warm water enough to make the whole 20 gals. just so hot that you can hold your hand in it without burning, or about 70 degrees of heat; put in $1\frac{1}{2}$ pints of hop or brewers' yeast, worked into paste with 5 or 6 oz. flour. Let it work over night, then strain and bottle for use.

TABLE BEER.—Malt, 8 bushels, hops, 7 lbs., molasses, 25 lbs.; brew for 10 barrels; smaller quantity in proportion.

HOP BEER.—Hops, 6 ounces, molasses, 5 quarts; boil the hops till the strength is out, strain them into a 30-gallon barrel; add the molasses and 1 teacupful of yeast, and fill up with water; shake it well, and leave the bung out till fermented, which will be in about 24 hours. Bung up, and it will be fit for use in about three days.

MOLASSES BEER.—Hops, 1 oz.; water, 1 gal.; boil for 10 minutes, strain, add molasses, 1 lb., and when luke-warm, yeast, 1 spoonful. Ferment.

ROOT BEER.—For 10 gallons beer, take 3 lbs. common burdock root, or 1 oz. essence of sassafras; $\frac{1}{2}$ lb. good hops; 1 pint corn, roasted brown. Boil the whole in 6 gallons pure water until the strength of the materials is obtained; strain while hot into a keg, adding enough cold water to make 10 gallons. When nearly cold add clean molasses or syrup until palatable,—not sickishly sweet. Add also as much fresh yeast as will raise a batch of eight loaves of bread. Place the keg in a cellar or other cool place, and in forty-eight hours you will have a keg of first-rate sparkling root beer.

CHEAP BEER.—Water, 15 gals.; boil half the water with $\frac{1}{2}$ lb. hops; then add to the other half in the tun, and mix well with 1 gal. molasses and a little yeast.

To RESTORE SOUR BEER.—Good hops, $\frac{1}{2}$ lb., powdered chalk, 2 lbs. Put in the hole of the cask, and bung close for a few days; for frosted beer, add some finings, a few handfuls of flour, and some scalded hops; forropy beer, use a handful or two of flour, the same of hops, with a little powdered alum to each barrel. Rummage well.

To IMPROVE THE FLAVOR OF BEER.—Bruised ginger, 1 oz.; bruised cloves, $\frac{1}{2}$ oz.; a few scalded hops and a doz. broken coarse biscuits to every two barrels. Rummage well.

LEMONADE. -- White sugar, 1 lb., tartaric acid, $\frac{1}{4}$ ounce, essence of lemon, 30 drops, water 3 qts. Mix.

CREAM SODA.—Loaf sugar, ten lbs., water, 3 gal. ; warm gradually so as not to burn ; good rich cream, 2 quarts, extract vanilla, 1½ ounces, extract nutmeg, ½ ounce, tartaric acid, 4 ounces. Just

bring to a boil. The solution will crystallize in about 24 hours of three, 8-ounce glass, if used. is used.

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bring to a boiling heat; for if you cook it any length of time, it will crystallize; use 4 or 5 spoonfuls of this syrup instead of three, as in other syrups; put $\frac{1}{4}$ teaspoonful of soda to a glass, if used without a fountain. For charged fountains no acid is used.

FREEZING PREPARATION.—Common sal-ammoniac, well pulverized, 1 part; saltpetre, 2 parts; mix well together. Then take common soda well pulverized. To use, take equal quantities of these preparations (which must be kept separate and well covered previous to using) and put them in the freezing pot; add of water a proper quantity, and put in the article to be frozen in a proper vessel; cover up, and your wants will soon be supplied. For freezing cream or wines this cannot be beat.

PORTABLE LEMONADE.—Tartaric acid, 1 ounce, white sugar, 2 lbs., essence of lemon, quarter ounce; powder and keep dry for use. One dessert spoonful will make a glass of lemonade.

IMPERIAL CREAM NECTAR.—Part 1st, take 1 gallon water, loaf sugar, 6 lbs., tartaric acid, 6 ounces, gum arabic, 1 ounce. Part 2d, flour, 4 teaspoonfuls, the whites of 5 eggs; beat finely together; then add $\frac{1}{2}$ pint water; when the first part is blood warm, put in the second; boil 3 minutes, and it is done. Directions: 3 table-spoonfuls of syrup to two-thirds of a glass of water; add one-third teaspoonful of carbonate of soda, made fine; stir well, and drink at your leisure.

PEPPERMINT CORDIAL.—Good whisky, 10 galls., water, 10 galls., white sugar, 10 lbs., oil peppermint, 1 ounce, in 1 pint alcohol, 1 lb. flour well worked in the fluid, $\frac{1}{2}$ lb. burned sugar to color. Mix, and let it stand one week before using. Other oil in place of peppermint, and you have any flavor desired.

SILVER-TOP DRINK.—Water, 3 qts., white sugar, 4 lbs., ess. of lemon, 4 teaspoonfuls, white of 5 eggs, beat with 1 tablespoonful of flour; boil to form a syrup; then divide into equal parts, and to one add 3 ounces tartaric acid, to the other 4 ounces of carbonate of soda; put in a teaspoonful of each of the syrups, more or less (according to the size of the glass), to two-thirds of a glass of water; drink quick.

SANGAREE.—Wine, ale, or porter, or two-thirds water, hot or cold—according to the season of the year, loaf sugar to taste, with nutmeg.

STOUGHTON BITTERS.—Gentian, 4 ounces, orange peel, 4 ounces, Columbo, 4 ounces, camomile flowers, 4 ounces, quassia, 4 ounces, burned sugar, 1 lb., whisky, $2\frac{1}{2}$ galls. Mix and let it stand 1 week. Bottle the clear liquor.

SODA SYRUPS.—Loaf or crushed sugar, 8 lbs., pure water, 1 gallon, gum arabic, 2 oz.; mix in a brass or copper kettle. Boil until the gum is dissolved, then skim and strain through white flannel, after which add tartaric acid, $5\frac{1}{2}$ oz.; dissolve in hot water; to flavor, use extract of lemon, orange, vanilla, rose, sarsaparilla, strawberry, &c., &c., $\frac{1}{2}$ oz. or to your taste. If you use juice of lemon, add $2\frac{1}{2}$ lbs. of sugar to a pint, you do not need any tartaric acid with it; now use two tablespoonfuls of syrup to $\frac{3}{4}$ of a tumbler of water, and $\frac{1}{4}$ teaspoonful of super-carbonate of soda, made fine; drink quick. For soda fountains, 1 oz. of super-carbonate of soda is used

to 1 gallon of water. For charged fountains no acids are needed in the syrups.

COMMON SMALL BEER.—A handful of hops to a pail of water, a pint of beer and half a pint of molasses, a cup of yeast and a spoonful of ginger.

ROYAL POP.—Cream tartar, 1 lb., ginger, $1\frac{1}{2}$ oz., white sugar, 7 lbs., essence of lemon, 1 drachm, water, 6 galls., yeast, $\frac{1}{2}$ pint. Tie the corks down.

RASPBERRY SYRUP WITHOUT RASPBERRIES.—First make a syrup with 36 lbs. of white sugar, and 10 gallons of water, and put it into a clean mixing barrel. Then dissolve $\frac{1}{2}$ lb. of tartaric acid in 1 qt. of cold water, and add to the syrup. Next take $\frac{1}{2}$ lb. orris root, and pour over it half a gallon of boiling water; let it infuse until cold, then filter, and put it into the mixing barrel, stirring it well.

TO COLOR.—Boil $\frac{1}{2}$ oz. of cochineal; $\frac{1}{2}$ oz. cream tartar; $\frac{1}{2}$ oz. saleratus, and $\frac{1}{2}$ oz. alum in 1 qt. of water till you get a bright red color, and add this to the syrup till the color suits. The above is a very valuable receipt, and will make 16 gals. syrup at a very low cost per gallon. If it is desirable to produce a richer syrup, add more sugar. Colors ought to be made in a brass or copper kettle.

BOTTLED SODA WATER WITHOUT A MACHINE.—In each gallon of water to be used, carefully dissolve $\frac{1}{2}$ lb. of crushed sugar, and one ounce of super-carbonate of soda; then fill pint bottles with this water, have your corks ready; now drop into each bottle $\frac{1}{2}$ dram of pulverized citric acid, and immediately cork and tie down. Handle the bottles carefully, and keep cool until needed. More sugar may be added if desired.

OYSTER SOUP.—To each dozen or dish of oysters put $\frac{1}{2}$ pint of water; milk, 1 gill; butter $\frac{1}{2}$ oz.; powdered crackers to thicken; bring the oysters and water to a boil, then add the other ingredients previously mixed together, and boil from three to five minutes only. Season with pepper and salt to taste.

MOCK TERRAPIN.—*A supper dish.* Half a calf's liver; seasoned, fry brown. Hash it, not very fine, dust thickly with flour, a teaspoon mixed mustard, as much cayenne pepper as will lie on a half lime; 2 hard eggs, chopped fine, a lump of butter as large as an egg, a tea cup of water. Let it boil a minute or two; cold veal will do, if liver is not liked.

MUTTON HARRICOT.—Take a loin of mutton, cut it into small chops, season it with ground pepper, allspice and salt, let it stand a night, and then fry it. Have good gravy well seasoned with flour, butter, catsup and pepper, if necessary. Boil turnips and carrots, cut them small, and add to the mutton stewed in the gravy, with the yolks of hard boiled eggs and force meat balls.

IMITATION APPLE BUTTER.—Vinegar, 1 qt.; cheap molasses, 1 qt.; mix together set over the fire till it commences to cook; take it off, add 10 tablespoonfuls of wheat flour, and cold water to make a batter then add 1 qt. scalding water, stir and cook for 15 minutes.

BLACKBERRY WINE.—Wash the berries, and pour 1 qt. of boiling water to each gal. Let the mixture stand 24 hours, stirring occasionally; then strain and measure into a keg, adding 2 lbs. sugar, and good rye whisky 1 pint, or best alcohol, $\frac{1}{2}$ pint to each gal. Cork tight, and put away for use. The best wine that can be made.

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LEMON SYRUP.—Havana sugar, 1 lb., boil in water down to a quart, drop in the white of 1 egg, and strain it. Add $\frac{1}{4}$ oz. tartaric acid; let it stand 2 days; shake often; 12 drops essence of lemon will much improve it.

SUPERIOR RAISIN WINE.—Take 30 lbs. of chopped raisins free from stems and dust; put them in a large keg, and add to them 10 gals. soft water; let them stand two weeks unbunged, shaking occasionally (warm place in winter), then strain through woollen, or filter; color with burnt sugar; bottle and cork well for use. The more raisins the better the wine, not exceeding 5 lbs. to each gallon.

RAISIN WINE EQUAL TO SHERRY.—Boil the proper quantity of water and let it stand till cold. To each gal. of this water add 4 lbs. of chopped raisins, previously well washed, and freed from stalks; let the whole stand for 1 month, stirring frequently; then remove the raisins, and bung up closely for 1 month more; then rack into another vessel, leaving all sediment behind, which must be repeated till it becomes fine; then to every 10 gals. add 6 lbs. of fine sugar, and 1 doz. of good oranges, the rinds being pared very thin, and infused in 2 qts. of brandy, which should be added to the liquor at its last racking. Let the whole stand three months in the cask, then bottle. It should remain bottled twelve months. To give it the flavor of Madeira, when it is in the cask, put in a couple of green citrons, and let them remain till the wine is bottled.

PORT WINE.—Worked cider, 42 gals.; good port wine, 12 gals.; good brandy, 3 gals.; pure spirits, 6 gals.; mix. Elderberries and sloes, and the fruit of the black haws, make a fine purple color for wines, or use burnt sugar.

AMERICAN CHAMPAGNE.—Good cider (crab-apple cider is the best), 7 gals.; best fourth-proof brandy, 1 qt.; genuine champagne wine, 5 qts.; milk, 1 gal.; bitartrate of potassa, 2 oz. Mix, and let stand a short time; bottle while fermenting. An excellent imitation.

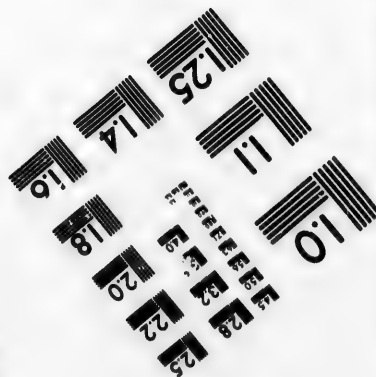
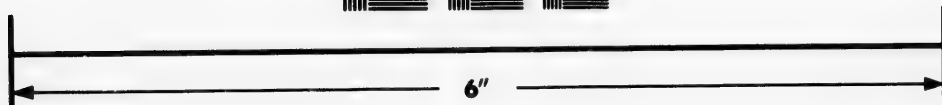
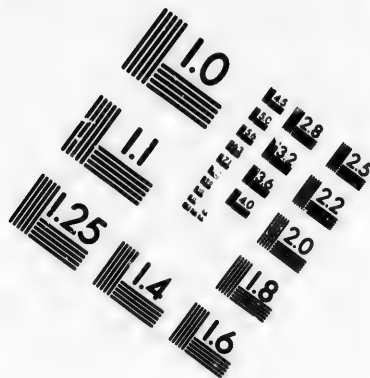
BRITISH CHAMPAGNE.—Loaf-sugar, 56 lbs.; brown sugar (pale), 48 lbs.; water (warm), 45 gals.; white tartar, 4 oz.; mix, and at a proper temperature add yeast, 1 qt.; afterwards sweet cider, 5 gals.; bruised wild cherries, 14 or 15 oz.; pale spirits, 1 gal.;orris-powder, $\frac{1}{4}$ oz. Bottle while fermenting.

BRITISH MADEIRA.—Pale malt, 1 bushel; boiling water, 12 gals.; mash and strain; then add white sugar, 4 lbs.; yeast, 1 lb. Ferment, next add raisin or Cane wine, 3 qts.; brandy, 3 qts.; sherry, 2 qts.; port, 2 qts.; bung down. The malt may be mashed again for bottle beer.

CURRENT AND OTHER FRUIT WINES.—To every gallon of expressed juice, add 2 gals. soft water, 6 lbs. brown sugar, cream tartar, $\frac{1}{4}$ oz.; and qt. brandy to every 6 gals.; some prefer it without brandy. After fermentation, take 4 oz. isinglass dissolved in 1 pt. of the wine, and put to each barrel, which will fine and clear it; when it must be drawn into clean casks, or bottled, which is preferable.

BLACKBERRY AND STRAWBERRY WINES are made by taking the above wine when made with port wine, and for every 10 gals.





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from 4 to 6 qts. of the fresh fruit, bruised and strained, are added, and let stand four days till the flavor is extracted; when bottling, add 3 or four broken raisins to each bottle.

MORELLA WINE.—To each quart of the expressed juice of the morella, or tame cherries, add 3 qts. water, and 4 lbs. of coarse brown sugar; let them ferment, and skim till worked clear; then draw off, avoiding the sediment at the bottom. Bung up, or bottle, which is best for all wines, letting the bottles lie always on the side, either for wines or beers.

LONDON SHERRY.—Chopped raisins, 400 lbs.; soft water, 100 gals.; sugar, 45 lbs.; white tartar, 1 lb.; cider, 16 gals. Let them stand together in a close vessel one month; stir frequently. Then add of spirits, 8 gals.; wild cherries bruised, 8 lbs. Let them stand one month longer, and fine with isinglass.

ENGLISH PATENT WINE FROM RHUBARB.—To each gal. of juice, add 1 gal. soft water, in which 7 lbs. brown sugar have been dissolved; fill a keg or barrel with this proportion, leaving the bung out, and keep it filled with sweetened water as it works off, until clear. Any other vegetable extract may be used if this is not liked: then bung down or bottle as you please. The stalks will yield $\frac{2}{3}$ their weight in juice; fine and settle with isinglass as above. This wine will not lead to intemperance.

VARIOUS WINES.—To 28 gals. clarified cider add good brandy, 1 gal.; crude tartar (this is what is deposited by grape wines), milk to settle it, 1 pt.; draw off 36 hours after thoroughly mixing.

GINGER WINE.—Put one oz. of good ginger-root bruised in 1 qt. 95 per. cent. alcohol; let it stand nine days, and strain; add 4 qts. water, and 1 lb. white sugar dissolved in hot water, color with tincture of sanders to suit. For bar-purposes add 1 pt. port wine.

ANOTHER.—To 1 qt. 95 per cent. alcohol add 1 oz. best ginger-root (bruised but not ground), 5 grs. capsicum, and 1 dr. tartaric acid. Let it stand one week and filter; now add 1 gal. water in which 1 lb. of crushed sugar has been boiled. Mix when cold. To make the color, boil $\frac{1}{2}$ oz. cochineal, $\frac{2}{3}$ oz. cream tartar, $\frac{1}{2}$ oz. saleratus, and $\frac{1}{2}$ oz. alum, in one pt. of water till you get a bright-red color.

TO RESTORE FLAT WINE.—Add 4 or 5 gals. of sugar, honey, or bruised raisins to every 100 gals., and bung close; a little spirit may be added, to roughen; take bruised sloes, or powdered catechu, and add to the wine in suitable proportions, or add a small quantity of bruised berries of the mountain ash, to allay inordinate flatness. Let it stand 2 hours and bottle, using yeast, of course, as before.

WHITE WINES are generally fined by isinglass in the proportion of $\frac{1}{4}$ oz. (dissolved in $\frac{1}{2}$ pts. of water, and thinned with some of the wine) to the hoghead. *Red Wines* are generally fined with the whites of eggs, in the proportion of 12 to 18 to each pipe; they must be well beaten to a froth with about 1 pt. of water, and afterwards mixed with a little of the wine, before adding them to the liquor. Rummage well.

CHAMPAGNE CIDER.—Good pale cider, 1 hhd.; spirit, 3 gals.; sugar, 20 lbs.; mix, and let it stand one fortnight; then fine with skimmed milk, $\frac{1}{2}$ gal.; this will be very pale, and a similar article, when pro-

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perly bottled and labelled, opens so brisk, that even good judges have mistaken it for genuine champagne.

BERLIN CARRAWAY CORDIAL.—Take 8 gals. spirit, 50 per cent. ; 1 oz. oil of carraway, which you dissolve in spirit 95 per cent. ; 8 lbs. sugar ; 8 lbs. water. Dissolve your sugar in the water ; mix, stir and filter.

STOMACH BITTERS EQUAL TO HOSTETTERS'.—European gentian root, 1½ oz. ; orange peel, 2½ oz. ; cinnamon, ½ oz. ; anise seed, ½ oz. ; coriander seed, ½ oz. ; cardamom seed, ½ oz. ; unground Peruvian bark, ½ oz. ; gum kino, ½ oz. ; bruise all these articles, and put them into the best alcohol, 1 pt. ; let it stand a week, and pour off the clear tincture ; then boil the dregs a few minutes in 1 qt. of water, strain, and press out all the strength ; now dissolve loaf sugar, 1 lb., in the hot liquid, adding 3 qts. cold water, and mix with the spirit tincture first poured off, or you can add these, and let it stand on the dregs if preferred.

BOKER'S BITTERS.—Rasped quassia, 1½ oz. ; calamus, 1½ oz. ; powdered catechu, 1½ oz. ; cardamom, 1 oz. ; dried orange peel, 2 oz. ; macerate the above ten days in ½ gal. strong whisky, and then filter, and add 2 gals. water ; color with mallow or malva flowers.

CURACOA CORDIAL, 40 GALS.—Essence of bitter oranges, 2 oz. ; ess. o neroli, 2 oz. ; ess. of cinnamon, ½ oz. ; 2 drs. mace, infused in alcohol. Dissolve the above essences in ½ gal. alcohol, 95 per cent. ; then put in a clean barrel 13 gals. alcohol, 85 per cent. ; 26 gals. sugar syrup, 30 degrees Baumé ; and add 1 gal. perfumed spirit as above. Color with saffron or turmeric.

CURACOA D'HOLLANDE, 20 GALS.—Curacao orange-peel, 2 lbs. ; ½ lb. Ceylon cinnamon. Let them soak in water ; boil them for five minutes with the juice of 32 oranges and 14 gals. of plain white syrup ; then add 6 gals. alcohol, 95 per cent. ; strain, filter ; color dark yellow with sugar coloring.

ANISETTE CORDIAL, 40 GALS.—Put in a barrel 13 gals. alcohol, 75 per cent. Dissolve 3½ oz. essence of green anise-seed in 1 gal. 95 per cent. alcohol, and add ½ gal. orange-flower water ; 8 or ten drops infusion of mace, and 5 drops essence of cinnamon. Then put in the barrel 26 gals. sugar syrup, 25 degrees Baumé ; stir fifteen minutes, and let it rest four or five days ; then filter. Add 2 or 3 sheets of filtering paper.

RATAFIA.—Ratafia may be made with the juice of any fruit. Take 3 gals. cherry juice, and 4 lbs. sugar, which you dissolve in the juice ; steep in 2½ gals. brandy ten days ; 2 drs. cinnamon, 24 cloves ; 16 oz. peach-leaves ; 8 oz. bruised cherry kernels. Filter, mix both liquids, and filter again.

ARRACK PUNCH SYRUP.—53½ lbs. sugar ; 3½ gals. water. Boil up well ; then add 1½ gals. lemon-juice to the boiling sugar, and stir till the liquid is clear ; pour it in a clean tub, and when nearly cool, add 5 gals. Batavia arrack, then filter.

SIMPLE SYRUP.—To 8 lbs. best white sugar add 2 qts. water, and the whites of 2 eggs ; stir until all the sugar is dissolved ; simmer for two or three minutes : skim well, and strain through a fine flannel bag.

SASSAPARILLA SYRUP.—To simple syrup add 10 drops oil of anise, 20 drops oil of wintergreen, 20 drops oil of sassafras, and 6 oz. of caramel or coloring to the gallon. Before the oils are added to the

syrup, they should be cut by grinding them in a mortar with as much sugar as they will moisten, or mix with a small quantity of alcohol.

VANILLA SYRUP.—To simple syrup, add $\frac{1}{4}$ oz. of ext. of vanilla to the gallon.

GINGER SYRUP.—Bruised Jamaica ginger, 1 oz.; boiling water, 1 pt.; macerate for four hours; add fine white sugar, 2 lbs.; and strain through a fine flannel bag. Ginger syrup may also be made by adding 2 oz. of the ext. of ginger to 1 gal. of simple syrup.

STRAWBERRY SYRUP WITHOUT STRAWBERRIES.—Add to 1 gal. simple syrup 2 teaspoons of essence of strawberry, and $\frac{1}{4}$ oz. tartaric acid; color with coloring made as follows: boil 1 oz. of cochineal with half a teaspoonful of cream tartar.

STRAWBERRY SYRUP.—Inclose fresh strawberries in a coarse bag, press out the juice, and to each qt. add 1 pt. water and 6 lbs. white sugar; dissolve by raising it to the boiling point, and strain; bottle and cork hot, and keep in a cool place.

BLACKBERRY SYRUP is made as directed for strawberry, adding to each qt. 1 oz. best French brandy.

WILD CHERRY SYRUP.—Steep 4 oz. wild cherry bark, well bruised in 1 pt. of cold water, for thirty-six hours; press out the infusion; let it stand till clear, decant and add $1\frac{1}{2}$ lbs. fine white sugar; mix and strain.

NECTAR SYRUP.—Add to orgeat syrup 1 pt. of best port wine, and $\frac{1}{4}$ oz. extract of vanilla to the gal.; or flavor 1 gal. simple syrup with 1 teaspoonful ext. of nectar.

ORGEAT SYRUP.—Take 3 oz. of sweet almonds, and $\frac{1}{4}$ oz. bitter almonds; gum arabic, in powder, $\frac{1}{4}$ oz.; sugar in powder, 3 oz.; rub together in a mortar, adding water from time to time until the mixture measures 1 qt. Strain through a cloth, and mix with 1 gal. of simple syrup.

ORANGE FLOWER SYRUP.—Add to 1 gal. of simple syrup, $\frac{1}{4}$ oz. ext. of orange flowers.

ORANGE SYRUP.—Grate off the outside yellow peel of fresh and ripe oranges; cut them and express the juice: to each qt. add 1 pt. water and 6 lbs. sugar, previously well mixed with the grated peel. Dissolve by gentle heat, then strain.

PINE APPLE SYRUP.—Pare and mash the fruit in a marble or porcelain mortar, with a small quantity of sugar; express the juice, and, for each qt. take $1\frac{1}{2}$ pts. of water and 6 lbs. fine sugar; boil the sugar and water; then add the juice; remove from the fire; skim and strain. Or make it with the essence directed for strawberry.

PEAR SYRUP.—Make as directed for pine apple syrup; or use the essence of pear, by adding to each gallon of simple syrup, 2 teaspoonfuls of essence of pear, and $\frac{1}{4}$ oz. tartaric acid.

BANANA SYRUP.—Make as directed for pine apple syrup, or with the appropriate essence and acid as above.

APPLE SYRUP.—Make as directed for pine apple syrup, or with the appropriate fruit and essences as above.

CREAM SYRUP.—Fresh cream, 1 pt.; fresh milk, 1 pt.; fine powdered sugar, 3 lbs.; beat the sugar with the milk, and the whites of 2 eggs; then mix with the cream. Flavor with lemon, vanilla, or strawberry. Keep in a cool place, well bottled.

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BUTYRIC ETHER is much used to impart a pine apple flavor to rum. Dissolved in 8 or 10 parts of alcohol, it forms the pine apple essence. From 20 to 25 drops of this essence, added to 1 lb. sugar, containing a little citric acid, imparts to the mixture a strong taste of pine apple.

AMYLO-ACETIC ETHER is a preparation of fruit-oil and other ingredients, and, when diluted with alcohol, it is sold as *essence of Jargonelle pear*, and is used for flavoring different liquors. Fifteen parts amylo-acetic ether, with half a part of acetic ether, dissolved in 100 parts of alcohol, form what may be called the *Bergamot-pear essence*, which, when employed to flavor sugar, acidulated with a little citric acid, imparts the odor of the Bergamot pear, and a fruity, refreshing taste.

PELARGONATE OR ETHYLIC ETHER (pelargonic ether) has the agreeable odor of the quince, and, when dissolved in alcohol in due proportion, forms the *quince essence*.

ACETATE OF AMYLIC ETHER (same as amylo ether), mixed with *butyric ether*, forms in alcoholic solution the *banana essence*.

VALERIANATE OF AMYLIC ETHER.—An alcoholic solution of this ether in the proportion of 1 part to 6 or 8 of alcohol, forms a flavoring liquid under the name of *apple essence*.

MILK PUNCH.—One tablespoonful of fine white sugar, 2 ditto of water, 1 wine glass of Cognac brandy, $\frac{1}{2}$ ditto Santa Cruz rum, $\frac{1}{2}$ tumblerful of shaved ice; fill with milk. Shake the ingredients well together, and grate a little nutmeg on top. To make it hot, use hot milk and no ice.

GLASGOW PUNCH.—Melt lump-sugar in cold water, with the juice of a couple of lemons, passed through a fine wire strainer; this is sherbet, and most be well mingled. Then add old Jamaica rum, one part of rum to five of sherbet. Cut a couple of lemons in two, and run each section rapidly around the edge of the jug or bowl, gently squeezing in some of the delicate acid, when all is ready.

MINT JULEP.—One tablespoonful of white pulverized sugar, $2\frac{1}{2}$ ditto water; mix well with a spoon. Take 3 or 4 sprigs of fresh mint, press them well in the sugar and water, add $1\frac{1}{2}$ wine glasses of Cognac brandy, and fill the glass with shaved ice, then draw out the sprigs of mint, and insert them in the ice with the stems downwards, so that the leaves will be above in the shape of a bouquet; arrange berries and small pieces of sliced orange on top in a tasty manner, dash with Jamaica rum, and sprinkle sugar on top. Sip with a glass tube or straw.

CIDER NECTAR.—One qt. cider, 1 bottle soda water, 1 glass sherry, 1 small glass brandy, juice of half a lemon, peel of $\frac{1}{4}$ of a lemon, sugar and nutmeg to taste. Flavor it with extract of pine apple, strain, and ice it all well.

HALF AND HALF.—In London, this drink is made by mixing half porter and half ale; in America, it is made by mixing half new and half old ale.

APPLE TODDY.—One tablespoonful of fine white sugar, 1 wine-glass of cider brandy, $\frac{1}{4}$ of a baked apple. Fill the glass two-thirds full of boiling water, and grate a little nutmeg on top.

APPLE PUNCH.—Lay in a china bowl slices of apples and lemons alternately, each layer being thickly strowed with powdered sugar.

Pour over the fruit, when the bowl is half filled, a bottle of claret; cover, and let it stand for 6 hours. Then pour it through a muslin bag, and it is all ready.

OLD MAN'S MILK.—One wine-glass of port wine, 1 teaspoonful of sugar. Fill the tumbler one third full of hot milk.

PERFECT LOVE. One tablespoonful sugar, 1 piece each of orange and lemon peel. Fill the tumbler one-third full of shaved ice, and fill balance with wine; ornament in a tasty manner with berries in season; sip through a straw.

MOLASSES CANDY.—West-Indian molasses, 1 gallon; brown sugar, 2 lbs.; boil the molasses and sugar in a preserving kettle over a slow fire; when done enough it will cease boiling; stir frequently, and, when nearly done, stir in the juice of four lemons, or two teaspoonfuls of essence of lemon; afterwards butter a pan, and pour out.

CONFECTIONERS' COLORS.—*Red*, cochineal, 1 oz.; boil 5 minutes in half pint water; then add cream tartar, 1 oz.; pounded alum, $\frac{1}{2}$ oz.; boil 10 minutes longer, add sugar, 2 oz.; and bottle for use. *Blue*, put a little warm water on a plate, and rub in indigo till the required color is got. *Yellow*, rub with some water a little yellow gamboge on a plate, or infuse the heart of a yellow-lily flower with milk-warm water. *Green*, boil the leaves of spinach about 1 minute in a little water, and, when strained, bottle for use.

TO CANDY SUGAR.—Dissolve 2 parts of double refined sugar in 1 of water. Great care must be taken that the syrup does not boil over, and that the sugar is not burnt. The first degree is called the thread, which is subdivided into the little and great thread; if you dip your finger in the syrup, and apply it to the thumb, the tenacity of the syrup will, on separating the finger and thumb, afford a thread which shortly breaks, this is the little thread; if the thread admits of a greater extension of finger and thumb, it is called the great thread; by longer boiling you obtain the pearl, which admits of being drawn without breaking by the utmost extension of finger and thumb; this makes candied sugar: by further boiling you obtain the *blue*, which is known by dipping a skimmer with holes in the syrup, and blowing through them; if bubbles are perceived, you have got the blow. The *feather* implies more numerous bubbles, and then the sugar will fly off like flakes while the skimmer is being tossed. By boiling longer, you obtain the *crack*; it will crack when broken, and does not stick to the teeth; dip a teaspoon into the sugar, and let it drop to the bottom of a pan of cold water. If the sugar remains hard, it has attained the degree termed *crack*.

FIG CANDY.—Take 1 lb. of sugar and 1 pint of water; set over a slow fire. When done, add a few drops of vinegar and a lump of butter, and pour into pans in which split figs are laid.

RAISIN CANDY can be made in the same manner, substituting stoned raisins for the figs. Common molasses candy is very nice with all kinds of nuts added.

SCOTCH BUTTER CANDY.—Take 1 lb. of sugar and 1 pint of water; dissolve, and boil. When done, add one tablespoonful of butter, and enough lemon juice and oil of lemon to flavor.

COMMON LEMON CANDY.—Take 3 lbs. of coarse brown sugar; add to it three teacupfuls of water, and set over a slow fire for half

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an hour; put to it a little gum arabic dissolved in hot water; this is to clear it. Continue to take off the scum as long as any rises. When perfectly clear, try it by dipping a pipe-stem first into it and then into cold water, or by taking a spoonful of it into a saucer; if done, it will snap like glass. Flavor with essence of lemon and cut it into sticks.

PEPPERMINT, ROSE, OR HOARHOUND CANDY.—They may be made as lemon candy. Flavor with essence of rose or peppermint or finely powdered hoarhound. Pour it out in a buttered paper, placed in a square tin pan.

POPPED CORN, dipped in boiling molasses, and stuck together, forms an excellent candy.

ROCK CANDY.—To make fine rock candy, clarify double refined white sugar, filter it, and boil it till it is ready to crystallize, or boiled to a blister. The boiling sugar must measure 35° on the syrup weight, a degree more or less prevents its crystallization. Then take a brass kettle, of about 16 or 18 inches diameter and from 6 to 8 inches deep, smooth and polished on the inside. Make 8 or 10 small holes at equal distances from each other in a circle around the sides of the kettle, about 2 inches from the bottom; pass threads through these from one side to the other, and stop the holes on the outside with paste or paper to prevent the syrup from running out. Having thus prepared the kettle, pour in the syrup, till it rises about an inch above the threads; then place it in a stove moderately heated, and leave it to crystallize, agitating it from time to time. The crystallization will take place in six or seven days. As soon as the crystals are formed, pour off the remaining syrup, and throw in a little water to wash the crystals that are left at the bottom of the vessel. So soon as the mass is thoroughly drained set it in a very hot stove, leave it for two days, when it is fit for use. *Straw-coloured rock candy* is made by substituting brown for loaf sugar. The syrup must be boiled over a very hot fire in order to render the candy perfectly white. The sides of the kettle should be sponged repeatedly during the boiling process, to prevent the sugar from adhering and burning.

ORANGE ROCK CANDY is made by flavoring the syrup with a couple of teaspoonfuls of orange flower water, and coloring with saffron, just as the syrup is about to be taken from the fire. *Rose Rock Candy* it flavored with rose water, and colored with clarified carmine lake. *Vanilla Rock Candy* is perfumed with vanilla, and colored with liquid violet. The degree of coloring may be tested by dropping a little of the colored syrup on a sheet of white paper.

GINGER CANDY.—Dissolve 1 lb. double-refined sugar in $\frac{1}{2}$ pint of spring water; set it over a clear fire, and let it boil to a thin syrup. Have ready a teaspoonful of powdered ginger, mix it smoothly with 2 or 3 spoonfuls of the syrup, then stir it gradually into the whole. Boil the mixture into a *flake*, watching it carefully, that it may not exceed this point; then add the freshly grated rind of a large lemon, and stir the sugar constantly and rapidly until it fall in a mass from the spoon, without sinking when dropped upon a plate. If boiled for a moment beyond this point, it will fall into a powder. Should this happen by mistake, add a

little water, and boil to the proper consistency. Dip the candy from the kettle, and drop it in small cakes upon buttered pans, then set it away to cool.

CREAM CANDY.—To 3 lbs. loaf sugar add $\frac{1}{2}$ pt. water, and set it over a slow fire for half an hour; then add a teaspoonful of gum arabic dissolved, and a tablespoonful of vinegar. Boil it till it is brittle, then take it off, and flavor with vanilla, rose, or orange. Rub the hands with sweet butter, and pull the candy till it is white; then twist or break it, or stretch it out into thin white strips, and cut it off.

RED VERDUN SUGARED ALMONDS.—Dry the almonds in a stove by a slow fire. When dry enough to snap between the teeth, put them into a swinging basin and gum them by throwing over them a little gum arabic solution, cold; swing them constantly till dry; then give them another coating of gum arabic mixed with 4 oz. sugar, and swing them again till dry, using no fire. When they are thoroughly dry, set them over a moderate fire. Dissolve some sugar in orange or rose water, not too thin, set it over the fire 2 or 3 minutes, strain it through a sieve, and pour it over the almonds in the basin. Swing them till they are thoroughly coated and dried; then add another coating, composed of 2 parts of carmine, one part of gum, and one part of sugar, and proceed as before. If the almonds are not perfectly covered, give them a coating in which there is considerable gum; and when thoroughly moistened, throw on them some sifted sugar, stir till the mixture is all absorbed, then add successive coatings of sugar till they are large enough, and put them into the stove to remain till the next day, when in order to *whiten* them, you will proceed to boil 6 or 7 lbs. of fine clarified sugar to a blister, add 1 lb. of starch after taking it from the fire, stirring it constantly till a paste is formed a little thicker than that used for pastilles; a few drops of blue lake may be added to produce a pearl white. Put the almonds, warm, into the swinging basin, add enough of the prepared sugar to coat them, swing the basin till they are nearly dry, then set on the fire to finish the drying, then take the basin off the fire, heap them up in the middle, so as to allow the bottom of the vessel to cool; then add the coating of sugar, swing and dry them as before, and continue the process until 4 successive coatings of equal thickness have been given; then heat them well in the basin, put them into pans, and set them in the stove to remain over night. You will then proceed to *polish* them by giving them a coat of the prepared sugar and starch, and shake them violently until they are quite dry; give them another coating and proceed as before, and continue the process until they have received 4 successive coatings, when they will generally be found sufficiently polished. When the polishing is finished, put the almonds over a fire and stir gently till all are thoroughly heated, then place in a stove till the next day in a wicker basket lined with paper.

SPANISH SUGARED ALMONDS.—Make verdun sugared almonds about the size of pigeon's eggs, whiten and polish them by the previous directions, and paint different designs on them when completed.

SUPERFINE VANILLA SUGARED ALMONDS.—Proceed in the same manner as in the manufacture of verdun sugared almonds, make

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the solution of sugar in pure water; crush the essence of vanilla with a little sugar, and put in the solution.

COMMON SUGARED ALMONDS.—Common almonds, 20 lbs., sugar 8 lbs., farina, 20 lbs., starch, 2 lbs. Heat the almonds in the swinging basin, when they boil, make them into a pulp with diluted starch; give first a warm then a cold coating, cover them with farina, shaking the basin violently; then, when the almonds have been coated to the requisite size, spread them out on sieves; after a fortnight put them in a stove to finish drying; whiten them, and finish by the process described for the fine sugared almonds.

SUPERFINE CHOCOLATE SUGARED ALMONDS.—Caraccasa cacao-nuts, shelled and roasted, 20 lbs., Martinique sugar, 16 lbs., vanilla 4 drs., starch, 10 oz. The same method is required as for the superfine vanilla sugar plums, but care must be taken in adding the coatings of gum, to touch the cacao nuts lightly, as they are very easily broken.

SUPERFINE SUGARED FILBERTS.—Filberts, 50 lbs., sugar, 4 lbs., starch, 4 oz. Employ the same process as for sugared almonds and flavor to taste. Rose water is generally preferred on account of its color and fragrance.

CORIANDER SUGAR PLUMS.—Coriander, 2 lbs. farina, 30 lbs. sugar, 14 lbs. The washings of the basin are added to the coriander and farina without making a paste, and the method is followed that has been prescribed for the common sugared almonds; 8 lbs. of sugar are used to whiten them, and 6 to polish them; color after being polished with carmine, Prussian blue, and saffron.

CORIANDER IN BOTTLES.—Coriander, 10 lbs., farina, 10 lbs., sugar for the whitening, 3 lbs., starch, 1 lb. These are simply colored, and do not require brilliancy. They are made of the size of small peas, and are put into little bottles. In making these follow the receipt for common sugared almonds.

ANISE-SEED SUGAR PLUMS.—Dry 2 lbs. of green anise-seed in the stove; rub it in the hands to break off the stems, winnow to rid of dust, then put it into a swinging basin, and coat it with sugar boiled to a thread, so as to render the candies hard and brittle. When coated sufficiently, whiten and polish them, like the verdun sugared almonds. They vary in size, being generally as large as a pea.

MINT SUGAR PLUMS.—Dry some peppermint seed in a stove and coat it in the same manner as anise-seed (it must not, however, be whiter than rape seed), whiten and finish like anise-seed. The first coating is sometimes composed of equal parts of peppermint and sugar.

COMMON TWIST CANDY.—Clarify 3 lbs. of common brown sugar, and boil it till it is brittle, take it from the fire, pour it in buttered pans; rub the hands with a little butter, and as soon as it is cooled, pull it as you would molasses candy until it is perfectly white; then twist and braid it, and cut it into sticks.

CARAMEL is made by boiling clarified sugar till it is very brittle, then pouring it on an oiled slab or sheet of tin, and, as soon as it is cool enough to receive an impression with the finger, stamping it in small squares, about an inch in size with a caramel mould; then turning over the mass, wiping the bottom to remove any oil

that may have adhered from the slab, and putting it in a dry place to harden. If you have no caramel mould, you may score it on the slab with a common case knife, after which they are glazed with another coating of sugar. Keep them tightly closed from the air after they are made.

LEMON CARAMEL is made by grating the yellow rind of a lemon with a lump of sugar, add to this a few drops of lemon juice with water enough to dissolve the sugar completely, and stir the whole into the boiled syrup a few minutes before it is taken from the fire. *Orange and Lime caramels* are prepared in the same manner from these respective fruits. *Coffee caramel*, coffee, 2 oz., sugar, 1 lb. Make an infusion of the coffee, using as little water as possible; strain it through a cloth, and stir it gradually into the boiled syrup a few minutes before taking it from the fire. *Chocolate caramel*, chocolate, 4 oz., sugar, 1 lb. Dissolve the chocolate in as little water as possible, and add it to the boiled sugar, as in the coffee caramels. *Vanilla and Orange cream caramels* are made by using the respective essences of these fruits.

COCOA-NUT CANDY.—Pare and cut cocoa-nut into slips, or grate on a coarse grater the white meat of cocoa-nuts until you have $\frac{1}{2}$ a pound; dissolve $\frac{1}{2}$ lb. of loaf sugar in 2 tablespoonfuls of water; put it over the fire, and, as soon as it boils, stir in the cocoa-nut. Continue to stir it until it is boiled to a flake, then pour it on a buttered pan or marble slab, and cut it in whatever form you wish, when it is nearly cold. Lemon or other flavors may be added.

CANDY DROPS OR PASTILLES.—Pound and sift double-refined sugar, first through a rather coarse, then through a fine sieve. Put the sugar into an earthen vessel, and dilute it with the flavoring extract, mixed with a little water. If too liquid, the syrup will be too thin, and the drops will run together; while, if too thick, the syrup will be too compact, and cannot be poured out easily. When the sugar is mixed into a rather stiff paste, put it into a small saucepan with a spout, and set it over the fire. As soon as it begins to bubble up the sides of the saucepan, stir it once in the middle, take it from the fire, and drop it in small lumps, of the size and shape required, upon sheets of tin, to stand for 2 hours, then put them in the stove to finish drying. As soon as they are perfectly hard and brilliant, take them from the fire, otherwise they will lose their aroma. Color the syrup just before taking it from the fire.

ORANGE, JASMINE, AND CLOVE DROPS are made by mixing the above paste with these respective extracts:

FOR SALAD DROPS.—Water distilled from lettuce is used.

SAFFRON DROPS.—Make an infusion of saffron, strain it, let it cool, use it to mix the paste, and proceed as before.

HELIOTROPE DROPS.—Proceed in the same manner, flavoring the paste with a few drops oil of neroli, or oil of orange, jasmine, and tube-rose, and color violet.

PINK DROPS.—Flavor the paste with tincture of red pinks, and color with carmine lake.

CINNAMON DROPS.—Mix 5 drs. powdered cinnamon and 8 oz. of sugar with mucilage enough to make it into a paste, and proceed as above.

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MARSHMALLOW AND LICORICE drops are made the same way.

ROSE DROPS.—Mix the paste with rose water, and color with carmine lake. Proceed as above.

VIOLET DROPS.—Flavor the paste with tincture of Florence iris, and color with blue and carmine lakes. A few drops of tartaric acid may be added to sustain the blue.

LEMON AND ORANGE DROPS.—Rasp off the yellow rind of an orange or lemon; mix the raspings with double-refined sugar; add 5 grs. of tartaric acid to every pound of sugar, color with yellow lake or saffron, and proceed as before. If too much tartaric acid is used, the candies will adhere to the sheets of tin.

COFFEE DROPS.—Substitute a strong, filtered infusion of coffee for water, in mixing the paste.

CHOCOLATE DROPS.—For every pound of sugar, take 5 pts. good chocolate, pulverize it, and mix it into a paste, as already directed, taking care not to boil the paste too long, lest it granulate, and become unfit for use.

VANILLA DROPS.—Mix the paste with extract of vanilla, or finely-ground vanilla bean: to which add 2 oz. 3 grs. of tartaric acid, dissolved in water, to sustain the blue, without which it would disappear.

IMITATION CURRANT DROPS.—Mix the paste with water, adding a little essence of raspberry and of violet, or Florence iris, with a little tartaric acid dissolved in water; color with carmine, and proceed as above.

PEPPERMINT DROPS.—Dissolve finely-powdered sugar with a little strong peppermint-water in a saucepan with a spout. As soon as it is thoroughly dissolved, add an equal quantity of coarse-grained sugar with a few drops more of peppermint, stir the whole for a few moments, then drop the mixture on paper, and dry it in the open air. In the same way are made lemon, rose, vanilla, and other drops. Citric and tartaric acid may be used to increase the acidity of lemon drops.

EXTEMPORANEOUS PASTILLES.—Make the paste as usual, without flavoring the water, drop the pastilles upon paper, leave them for two hours, then take them off and put them into the stove to dry. When wanted for use, put the quantity required into a large-mouthed jar, and flavor as desired. For instance, to make 2 lbs. of peppermint drops, take 5 pts. of sulphuric ether in which are diluted a few drops of essence of peppermint, and pour it over the candies, then cover the jar, and shake it until they are thoroughly moistened; then place them on a sieve, and set them in the stove for 5 minutes, evaporate the ether. In this manner rose, orange, lemon, jonquil, tube-rose, mignonette, clove, cinnamon, or any other drops may be made, dissolving their essential oils in sulphuric ether.

GINGER CANDY TABLETS.—Take 1 lb. loaf sugar, a few drops of acetic acid or the juice of half a lemon, a dessert-spoonful of essence of Jamaica ginger. Boil the sugar with just water enough to dissolve it to the ball degree, then add the acid and the essence, and rub the sugar with the back part of the bowl of a silver spoon up against the sides of the sugar-boiler to whiten or grain it sufficiently to give to the whole an opalized appearance; then pour it into very small-sized moulds, measuring half an inch or an inch

oblong square, or else into a tin pan, the bottom part of which is marked out in small tablets, so that the candy may be easily broken into squares when dry. Smear the moulds slightly with oil of almonds. When the sugar is poured into the moulds, place in the screen for half an hour or more, to dry them hard.

ORANGE FLOWER CANDY TABLETS.—Ingredients: 1 lb. loaf sugar, a tablespoonful of orange-flower water, and a few drops of acetic acid. Proceed as directed in the preceding. No color.

VANILLA CANDY TABLETS.—Ingredients: 1 lb. of loaf sugar, a few drops of essence of vanilla sugar, and a few drops of acetic acid. Proceed as for ornaments in grained sugar.

PEPPERMINT CANDY TABLETS.—Ingredients: 1 lb. of loaf sugar, a few drops of essence of peppermint, and a few drops of acetic acid. Proceed as above. No color.

LIQUEUR CANDY TABLETS.—Ingredients: 1 lb. of loaf sugar, and a gill of any kind of liqueur. Boil the sugar to the crack, then incorporate the liqueur, and finish as in the preceding. No color.

CINNAMON CANDY TABLETS.—Use 1 lb. loaf sugar, and a few drops essence of cinnamon. Proceed as in the last. This may be colored rose pink, the color to be added while the sugar is boiling.

CLOVE CANDY TABLETS are prepared in the same way as the foregoing, essence of cloves being used instead of cinnamon.

ROSE CANDY TABLETS.—Use 1 lb. of loaf sugar, a few drops of essence of roses, a few drops of acetic acid, and a few drops of prepared cochineal. Proceed as in the preceding.

FRUIT CANDY TABLETS.—Use 1 lb. of loaf sugar, $\frac{1}{2}$ pint of the juice of any kind of fruit, either currants, cherries, strawberries, raspberries, &c., extracted by pressing with a spoon through a clean hair-sieve. Boil the sugar to the crack, and then incorporate the fruit juice by rubbing it in with the sugar, as directed in the preceding, and finish the candies as therein indicated.

TO FREE MOLASSES FROM ITS SHARP TASTE, AND TO RENDER IT FIT TO BE USED INSTEAD OF SUGAR.—Take 24 lbs. molasses, 24 lbs. water, and 6 pounds of charcoal, coarsely pulverized; mix them in a kettle, and boil the whole over a slow wood fire. When the mixture has boiled half an hour, pour it into a flat vessel, in order that the charcoal may subside to the bottom; then pour off the liquid, and place it over the fire once more, that the superfluous water may evaporate, and the molasses be brought to its former consistence. 24 lbs. of molasses will produce 24 lbs. of syrup.

PEPPERMINT LOZENGES.—Ingredients: 1 oz. of picked gum tragacanth soaked with 2 oz. of tepid water in a gallipot (this takes some 6 hours), and afterwards squeezed and wrung through a cloth, about $1\frac{1}{2}$ lbs. of fine icing sugar, and a teaspoonful of essence of peppermint. Work the prepared gum with the flattened fist on a very clean slab until it becomes perfectly white and elastic, then gradually work in the sugar, adding the peppermint when the paste has become a compact, smooth, elastic substance; a few drops of thick, wet, cobalt blue should also be added while working the paste, to give it a brilliant whiteness. The paste thus prepared is to be rolled out with fine sugar dredged over the slab to

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the thickness of two penny pieces, then if you possess a ribbed rolling-pin, use it to roll the paste again in cross directions, so as to imprint on its whole surface a small lozenge or diamond pattern. You now use your tin cutter to stamp out the lozenges, and as you do so place them on sugar powdered baking sheets to dry in the screen.

GINGER LOZENGES.—Proceed as in the foregoing; use a table-spoonful of essence of ginger, or 1 oz. of ground ginger to flavor, and a few drops of thick wet gamboge to color the paste. *Hoarhound Lozenges.* Ingredients; 1 oz. of gum dragon soaked in a gill of very strong extract of hoarhound, 1½ lb. of fine icing sugar. Proceed as for the peppermint lozenges. *Cinnamon Lozenges* are prepared in the same manner as ginger or peppermint lozenges, with this difference only; a dessert-spoonful of essence of cinnamon is to be used in the flavoring of them, a few drops of thick, ground, wet-burnt umber should be used with a pinch of carmine to give the paste the tinge of cinnamon color. *Clove Lozenges.* The same as peppermint lozenges, using essence of cloves for flavoring, and burnt umber to color the paste. *Orange Lozenges.* Ingredients; 1 oz. prepared gum, 1½ lb. sugar, 2 oz. of orange-sugar, the gum to be soaked in 2 oz. of orange flower water. Proceed as for peppermint lozenges. *Lemon Lozenges.* Ingredients; 1 oz. prepared gum, 1½ lb. of icing sugar, 2 oz. of lemon sugar, and a few drops of acetic acid. *Colt's foot Lozenges.* Ingredients; 1 oz. of gum dragon soaked in 2 oz. of orange flower water, 1½ lb. of fine icing sugar, and ½ oz. of essence of colt's foot. Proceed as for peppermint lozenges. *Cayenne and Catechu Lozenges.* Ingredients; 1 oz. of gum dragon soaked in 2 oz. of water, 2 lbs. fine icing sugar, ½ oz. essence of cayenne, and ½ oz. of prepared catechu. Proceed as for peppermint lozenges.

GUM PASTILLES, OR JUJUBES.—Ingredients; 1 lb. of picked gum arabic, 14 oz. of the finest sugar pounded and sifted, ½ gill of double orange flower water, and 1 pt. tepid water to soak the gum in, which is afterwards to be strained off clean. Put the soaked and strained gum into a sugar boiler with the sugar, and use a clean spoon to stir it over a very moderate fire, while it boils and reduces to the small pearl degree; then add the orange flower water, stir all together on the fire, remove the preparation from the stove, skim off the froth, and use the mixture to cast the jujubes in levelled layers of starch powder contained in a flat box.

SPANISH LICORICE JUJUBES.—Ingredients: 1 lb. picked gum arabic, 14 oz. of sugar, and 2 oz. of Spanish licorice dissolved in a gill of hot water, and afterwards strained clean. First prepare the gum and boil it with the sugar as directed in the preceding article, and when reduced by boiling to the small pearl degree, incorporate the prepared Spanish licorice with it, remove the scum from the surface, and finish the jujubes in the manner indicated above. *Raspberry Jujubes.* Ingredients: 1 lb. picked gum arabic soaked in a pint of hot water and afterwards strained, 14 oz. of sugar, 1 gill of filtered raspberry juice, and a few drops of cochineal. Proceed as directed in the foregoing case, adding the raspberry and coloring last. *Black Currant Jujubes.* Proceed in all respects as indicated for raspberry

jujubes, omitting the cochineal, black currant juice being used. *Red Currant Jujubes.* The same as black currant jujubes, red currant juice being used and a few drops of cochineal. *Ordinary Jujubes.* Ingredients: 1 lb. gum arabic soaked in 1 pt. of hot water and afterwards strained, 14 oz. sugar, $\frac{1}{2}$ oz. essence of roses, and a few drops of prepared cochineal. Let the mixture be prepared as for other jujubes, but instead of casting them in impressions made in starch-powder, when the preparation is ready, pour it into a very clean smooth tinned baking sheet to the depth of a quarter of an inch, and set it to dry in the screen, or hot closet (moderate heat); when sufficiently dried, so that on pressing the surface it proves somewhat elastic to the touch, remove it from the heat, and allow it to become cold; the sheet of jujube may then be easily detached, and is to be cut up with scissors in the shape of diamonds.

STICK APPLE SUGAR.—Boil the sugar to caramel, flavor with apple juice together with tartaric or other acid, pour it on a marble slab, draw it into sticks, cut them of equal length, then roll them on the slab till they are perfectly cold; when finished, wrap them in tissue-paper and put them in fancy envelopes.

CURRENT AND RASPBERRY PASTE DROPS.—Ingredients: 1 lb. of pulp (the currants and raspberries in equal proportions boiled, and afterwards rubbed through a sieve), 1 lb. of sifted sugar. Stir both together in a copper sugar-boiler or preserving pan over a brisk fire, until the paste becomes sufficiently reduced to show the bottom of the preserving pan as you draw the spoon across it; then proceed to lay out the drops about the size of a florin, using a spouted sugar boiler for the purpose. The drops should then be placed in the screen to dry, at a low heat for an hour or so. When the drops are dry, use a thin knife to remove them from the tin sheet on which you laid them out, and put them away between sheets of paper in closed boxes, in a dry place.

Damson Paste Drops. Ingredients: 1 lb. of damson thick pulp, 1 lb. bruised sugar. Stir the pulp and sugar on the fire until reduced to a thick paste, then proceed to lay out the drops on square sheets of polished tin; dry them in the screen (moderate heat), and remove them in the manner aforesaid. These drops may be prepared with all kinds of plums and also with gooseberries.

Pear Paste Drops. Use 1 lb. pear pulp (made by peeling the pears, and boiling them to a pulp with $\frac{1}{2}$ pt. of cider or perry, and rubbing this through a coarse sieve), 1 lb. of bruised sugar. Proceed as for damson paste. *Apple Paste Drops.* Use 1 lb. of apple pulp (made by peeling, slicing and boiling the apples with $\frac{1}{2}$ pt. cider), 1 lb. of bruised sugar. Proceed as in the foregoing cases, adding a few drops of cochineal to half of the paste for the sake of variety. *Pine Apple Paste Drops.* Use 1 lb. of pine apple pulp (made by first peeling, and then grating the pine-apple on a dish, using a clean coarse tin grater for the purpose), 1 lb. of bruised sugar. Proceed as in the former cases.

VASES, BASKETS, FIGURES, ANIMALS, &c., IN GRAINED SUGAR.—The sugar being boiled to the ball degree, add a few drops of acetic acid, and work the sugar with the back part of the bowl of a silver tablespoon up against the side of the sugar boiler,

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fetching up the whole in turns, so that every portion may acquire an opalized or whitish color. As soon as the sugar has been worked up to this state, which constitutes "graining," pour it immediately into the ready prepared mould; and when it has become perfectly set firm in the centre, you may turn the vase, basket, animal, or whatever the object may be, out of its mould, and place it in the screen or hot closet to dry, at a very moderate heat. Afterwards they may be painted in colors to imitate nature.

EVERTON TAFFEE.—To make this favorite and wholesome candy, take $1\frac{1}{2}$ pounds of moist sugar, 3 ounces of butter, a teacup and a half of water, and one lemon. Boil the sugar, butter, water, and half the rind of the lemon together; and, when done,—which will be known by dropping into cold water, when it should be quite crisp,—let it stand aside till the boiling has ceased, and then stir in the juice of the lemon. Butter a dish, and pour it in about a quarter of an inch in thickness. The fire must be quick, and the taffee stirred all the time.

CANDY FRUIT.—Take one pound of the best loaf sugar; dip each lump into a bowl of water, and put the sugar into your preserving kettle. Boil it down, and skim it until perfectly clear, and in a candying state. When sufficiently boiled, have ready the fruits you wish to preserve. Large white grapes, oranges separated into small pieces, or preserved fruits, taken out of their syrup and dried, are very nice. Dip the fruits into the prepared sugar while it is hot; put them in a cold place; they will soon become hard.

JELLIES WITHOUT FRUIT.—To 1 pint of water put $\frac{1}{4}$ oz. alum; boil a minute or two; then add 4 lbs. white sugar; continue the boiling a little; strain while hot; and, when cold, put in half a twenty-five cent bottle of extract of vanilla, strawberry, lemon, or any other flavor you desire for jelly.

PRIZE HONEY.—Good common sugar, 5 lbs.; water, 2 lbs.; bring gradually to a boil, skimming when cool; add 1 lb. bees' honey and 4 drops essence of peppermint. If you desire a better article, use white sugar, and $\frac{1}{4}$ lb. less water, $\frac{1}{4}$ lb. more honey.

ANOTHER.—Coffee sugar, 10 lbs.; water, 3-lbs.; cream tartar, 2 oz.; strong vinegar, 2 tablespoons; white of an egg well beaten; bees' honey, $\frac{1}{4}$ lb.; Lubin's extract of honeysuckle, 10 drops. Put on the sugar and water in a suitable kettle on the fire; when lukewarm, stir in the cream tartar and vinegar; add the egg; when the sugar is nearly melted put in the honey, and stir till it comes to a boil; take it off, let it stand a few minutes; strain, then add the extract of honeysuckle last; stand over night, and it is ready for use.

ANOTHER.—Common sugar, 4 lbs.; water, 1 pt.; let them come to a boil, and skim. Then add pulverized alum, $\frac{1}{4}$ oz.; remove from the fire, and stir in cream of tartar, $\frac{1}{4}$ oz., and water, or extract of rose, 1 tablespoonful, and it is fit for use.

TO KEEP FRUITS FRESH.—Rosin, 2 lbs.; tallow, 2 oz.; bees'-wax, 2 oz. Melt slowly over the fire in an iron pot, but don't boil. Take the fruit separately, and rub it over with pulverized chalk or whiting (to prevent the coating from adhering to the fruit), then dip it into the solution once, and hold it up a moment to set the coating, then pack away carefully in barrels, boxes, or on shelves,

in a cool place. Unequalled for preserving apples, pears, lemons, oranges, &c.

ACID DROPS.—Pound and sift into a clean pan 8 ozs. of double refined sugar, add slowly as much water as will render the sugar sufficiently moist not to stick to the stirring spoon, place the pan on a small stove or slow fire, and stir till it nearly boils, remove from the fire and stir in $\frac{1}{4}$ oz. tartaric acid. Place it on the fire for half a minute, then dip out small quantities from the pan, and let it fall in small drops on a clean tin plate; remove the drops in 2 hours with a knife. Ready for sale in 24 hours.

TANNERS, CURRIERS, BOOT, SHOE AND HARNESS MAKERS, MARBLE WORKERS, &c.

BEST COLOR FOR BOOT, SHOE, AND HARNESS EDGE.—Alcohol, 1 pint; tincture of iron, $1\frac{1}{4}$ oz.; extract logwood, 1 oz.; pulverized nutgalls, 1 oz.; soft water, $\frac{1}{4}$ pint; sweet oil, $\frac{1}{4}$ oz.; put this last into the alcohol before adding the water. Nothing can exceed the beautiful finish imparted to the leather by this preparation. The only objection is the cost.

CHEAP COLOR FOR THE EDGE.—Soft water, 1 gallon; extract logwood, 1 oz.; boil till the extract is dissolved; remove from the fire, add copperas, 2 oz., bichromate of potash and gum arabic, of each $\frac{1}{4}$ oz.; all to be pulverized.

SUPERIOR EDGE BLACKING.—Soft water, 5 gallons; bring to a boil, and add 8 oz. logwood extract, pulverized; boil 3 minutes, remove from the fire, and stir in $2\frac{1}{4}$ oz. gum arabic, 1 oz. bichromate of potash, and 80 grains prussiate of potash.

For a small quantity of this, use water, 2 quarts; extract of logwood, $\frac{1}{4}$ oz.; gum arabic, 96 grains; bichromate of potash, 48 grains; prussiate of potash, 8 grains. Boil the extract in the water 2 minutes; remove from the fire and stir in the others, and it is ready for use.

For tanners' surface blacking, which is not required to take on a high polish, the gum arabic may be omitted.

SIZING FOR BOOTS AND SHOES IN TREEING OUT.—Water, 1 quart; dissolve in it, by heat, isinglass, 1 oz.; adding more water to replace glass, by evaporation; when dissolved, add starch, 6 oz.; extract of logwood, bees'-wax, and tallow, of each, 2 oz. Rub the starch up first by pouring on sufficient boiling water for that purpose. It makes boots and shoes soft and pliable, and gives a splendid appearance to old stock on the shelves.

BLACK VARNISH FOR THE EDGE.—Take 98 per cent. alcohol, 1 pint; shellac, 3 oz.; rosin, 2 oz.; pine turpentine, 1 oz.; lampblack, $\frac{1}{4}$ oz.; mix; and when the gums are all cut, it is ready for use. This preparation makes a most splendid appearance when applied; to boot, shoe, or harness edge, and is equally applicable to cloth or wood, where a gloss is required after being painted.

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BEST HARNESS VARNISH EXTANT.—Alcohol, 1 gallon; white turpentine, 1½ lbs.; gum shellac, 1½ lbs.; Venice turpentine, 1 gill. Let them stand by the stove till the gums are dissolved, then add sweet oil, 1 gill; and color if you wish it with lampblack, 2 oz. This will not crack like the old varnish.

HARNESS OIL.—Neat's-foot oil, 1 gal., lampblack, 4 oz. Mix well.

BRILLIANT FRENCH VARNISH FOR LEATHER.—Spirit of wine, ½ pint; vinegar, 5 pints; gum senegal in powder, ¼ lb.; loaf sugar, 6 oz.; powdered galls, 2 oz.; green copperas, 4 oz. Dissolve the gum and sugar in the water; strain, and put on a slow fire, but don't boil; now put in the galls, copperas, and the alcohol; stir well for five minutes; set off; and when nearly cool, strain through flannel, and bottle for use. It is applied with a pencil brush. Most superior.

LIQUID JAPAN FOR LEATHER.—Molasses, 8 lbs.; lampblack, 1 lb.; sweet oil, 1 lb.; gum arabic, 1 lb.; isinglass, 1 lb. Mix well in 32 lbs. water; apply heat; when cool, add 1 quart alcohol; an ox's gall will improve it.

WATERPROOF OIL-BLACKING, Camphene, 1 pint; add all the India-rubber it will dissolve; currier's oil, 1 pint; tallow, 7 lbs.; lampblack, 2 oz. Mix thoroughly by heat.

SHOEMAKERS' HEEL BALLS.—Bees'-wax, 8 oz.; tallow, 1 oz.; melt, and add powdered gum arabic, 1 oz., and lampblack to color.

CEMENT FOR LEATHER OR RUBBER SOLES AND LEATHER BELTING.—Gutta percha, 1 lb.; India-rubber, 4 oz.; pitch, 2 oz.; shellac, 1 oz.; oil, 2 oz.; melt, and use hot.

OIL PASTE BLACKING.—Ivory black, 4 lbs.; molasses, 3 lbs.; sweet oil, 1 lb.; oil vitriol, 3 lbs.; mix, and put in tins.

TO DYE LEATHER BLUE, RED, OR PURPLE.—For *red*, steep it in alum water, then put it in a warm decoction of Brazil wood; *blue*, steep it in an indigo vat; *purple*, steep the skins in alum water, then put it in a warm decoction of logwood.

GOLD VARNISH.—Turmeric, 1 dram; gamboge, 1 dram; turpentine, 2 pints; shellac, 5 oz.; sandarach, 5 oz.; dragon's blood, 8 drams; thin mastic varnish, 8 oz.; digest with occasional agitation for fourteen days; then set aside to fine, and pour off the clear.

GRAIN BLACK FOR HARNESS LEATHER.—First stain in tallow; then take spirits turpentine, 1 pint; cream of tartar, 1 oz.; soda, 1 oz.; gum shellac, ½ oz.; thick paste, reduced thin, 2 quarts. Mix well. This will finish 12 sides.

STAINS FOR WOOD AND LEATHER.—RED.—Brazil wood, 11 parts: alum, 4 parts; water, 85 parts. Boil.

BLUE.—Logwood, 7 parts; blue vitriol, 1 part; water, 22 parts. Boil.

BLACK.—Logwood, 9 parts; sulphate of iron, 1 part; water, 25 parts. Boil.

GREEN.—Verdigris, 1 part; vinegar, 3 parts. Dissolve.

YELLOW.—French berries, 7 parts; water, 10 parts; alum, 1 part. Boil.

PURPLE.—Logwood, 11 parts; alum, 3 parts; water, 29 parts. Boil.

DEEP SKINS.—TANNING AND BUFFING FOR GLOVES.—For each skin, take a bucket of water, and put into it one qt. of lime; let the skin or skins lie in from 3 to 4 days; then rinse in clean water, hair, and

grain; then soak them in cold water to get out the glue; now scour or pound in good soap-suds for half an hour; after which take white vitriol, alum, and salt, 1 tablespoon of each to a skin; these will be dissolved in sufficient water to cover the skin, and remain in it for 24 hours; wring out as dry as convenient, and spread on with a brush $\frac{1}{2}$ pt. of currier's oil, and hang in the sun about 2 days; after which you will scour out the oil with soap-suds, and hang out again until perfectly dry; then pull and work them until they are soft; and if a reasonable time does not make them soft, scour out in suds again as before, until complete. The oil may be saved by pouring or taking it from the top of the suds, if left standing a short time. The buff color is given by spreading yellow ochre evenly over the surface of the skin, when finished, rubbing it in well with a brush.

TANNING WITH ACID.—After having removed the hair, scouring, soaking, and pounding in the suds, &c., as in the last recipe, in place of the white vitriol, alum, and salt, as there mentioned, take oil of vitriol (sulphuric acid), and water, equal parts of each, and thoroughly wet the flesh-side of the skin with it, by means of a sponge or cloth upon a stick; then folding up the skin, letting it lie for 20 minutes only, having ready a solution of sal-soda and water, say 1 lb. to a bucket of water, and soak the skin or skins in that for two hours, when you will wash in clean water, and apply a little dry salt, letting lie in the salt over night, or that length of time; then remove the flesh with a blunt knife, or, if doing business on a large scale, by means of the regular beam and flesh-knife; when dry, or nearly so, soften by pulling and rubbing with the hands, and also with a piece of pumice-stone. This, of course, is the quickest way of tanning, and by only wetting the skins with the acid, and soaking out in 20 minutes, they are not rotted.

ANOTHER METHOD.—Oil of vitriol, $\frac{1}{2}$ oz.; salt, 1 teacup; milk sufficient to handsomely cover the skin, not exceeding 3 qts.; warm the milk, then add the salt and vitriol; stir the skin in the liquid 40 minutes, keeping it warm; then dry, and work it as directed in the above.

LIQUID RED.—Channellers will find that no better or richer color for their purposes can be got than the red ink described under the Grocers' Department, diluted to the required shade. For color for the bottoms of shoes use tincture of red sanders.

BRIDLE STAIN.—Skimmed milk, 1 pt.; spirits of salts, $\frac{1}{2}$ oz.; spts. of red lavender, $\frac{1}{2}$ oz.; gum arabic, 1 oz.; and the juice of 2 lemons; mix well together, and cork for use; apply with a sponge; when dry, polish with a brush or a piece of flannel. If wished paler, put in less red lavender.

NEW TANNING COMPOSITION.—For harness leather, 4 lbs. catechu, 3 pts. common lye, 3 oz. of alum. For wax leather, (sp't leather) 3 lbs. catechu, 3 pts. common lye, 3 oz. alum. For calf skins, 2 lbs. catechu, 1 pt. lye, 2 oz. alum. For sheep-skins, 1 lb. catechu, 1 pt. lye, 1 oz. alum. The catechu by itself will make the leather hard and brittle, the lye will soften it; the alum, being only used for coloring, can be dispensed with, or other matter used in its place. The mixture is in every case boiled, and the leather is then immersed in it long enough to be thoroughly tanned, for which purpose the harness leather should be steeped from 18 to 20 days, wax leather

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from 12 to 14 days, calf-skin from 7 to 9 days, and sheep-skin from 2 to 4 days.

PROCESS OF TANNING CALF, KIP, AND HARNESS LEATHER IN FROM 6 TO 30 DAYS.—For a 12-lb. calf-skin, take 3 lbs. of terra japonica, common salt, 2 lbs.; alum, 1 lb.; put them into a copper kettle with sufficient water to dissolve the whole by boiling. The skin will be limed, haired, and treated every way as for the old process, when it will be put into a vessel with sufficient water to cover it, at which time you will put in 1 pint of the composition, stirring it well, adding the same amount each night and morning for three days, when you will add the whole, handling 2 or 3 times daily all the time tanning; you can continue to use the tanning liquid by adding half the quantity each time, by keeping these proportions for any amount. If you desire to give a bark color to the leather, you will put in 1 lb. of Sicily sumac; kip skins will require about 20 days, light house hides for harness 30 days, calf-skins from 6 to 10 days at most.

TO TAN RAW HIDE.—When taken from the animal, spread it flesh side up; then put 2 parts of salt, 2 parts of saltpetre and alum combined, make it fine, sprinkle it evenly over the surface, roll it up, let it alone a few days till dissolved; then take off what flesh remains, and nail the skin to the side of a barn in the sun, stretch tight, to make it soft like harness leather, put neat's-foot oil on it, fasten it up in the sun again; then rub out all the oil you can with a wedge-shaped stick, and it is tanned with the hair on.

FRENCH FINISH FOR LEATHER.—Take a common wooden pailful of scraps (the legs and pates of calf-skins are best), and put a handful each of salt and alum upon them, and let them stand three days; then boil them until they get a thick paste; in using, you will warm it, and in the first application put a little tallow with it, and for a second time a little soft soap, and use it in the regular way of finishing, and your leather will be soft and pliable, like French leather.

FRENCH PATENT LEATHER.—Work into the skin with appropriate tools 3 or 4 successive coatings of drying varnish, made by boiling linseed oil with white lead and litharge, in the proportion of one pound of each of the latter to one gallon of the former, and adding a portion of chalk or ochre, each coating being thoroughly dried before the application of the rest. Ivory black is then substituted for the chalk or ochre, the varnish thinned with spirits of turpentine, and five additional applications made in the same manner as before, except that it is put on thin and not worked in. The leather is rubbed down with pumice-stone, in powder, and then placed in a room at 90 degrees, out of the way of dust. The last varnish is prepared by boiling $\frac{1}{2}$ lb. of asphaltum with 10 lbs. of the drying oil used in the first stage of the process, and then stirring in 5 lbs. copal varnish and 10 lbs. of turpentine. It must have 1 month's age before using it.

CHEAP TANNING WITHOUT BARK OR MINERAL ASTRINGENTS.—The astringent liquor is composed of water, 17 gals.; Aleppo galls, $\frac{1}{2}$ lb.; Bengal catechu, $1\frac{1}{2}$ oz. and 5 lbs. of tormentil, or septfoil root. Powder the ingredients, and boil in the water 1 hour; when cool, put in the skins (which must be prepared by being

plunged into a preparation of bran and water for 2 days previously; handle them frequently during the first 3 days, let them alone the next 3 days, then handle three or four times in one day; let them lie undisturbed for 25 days more, when the process will be complete.

CANADIAN PROCESS.—The Canadians make four liquors in using the japonica.

The **FIRST** liquor is made by dissolving, for 20 sides of upper, 15 lbs. of terra japonica in sufficient water to cover the upper, being tanned. The **SECOND** liquor contains the same amount of japonica, and 8 lbs. of saltpetre also. The **THIRD** contains 20 lbs. of japonica, and 4½ lbs. of alum. The **FOURTH** liquor contains only 15 lbs. of japonica, and 1½ lbs. of sulphuric acid; and the leather remains 4 days in each liquor for upper; and for sole the quantities and time are both doubled. They count 50 calf-skins in place of 20 sides of upper, but let them lie in each liquor only 3 days.

FIFTY DOLLAR RECIPE FOR TANNING FUR AND OTHER SKINS.—Remove the legs and useless parts, soak the skin soft, and then remove the fleshy substances, and soak it in warm water 1 hour. Now take for each skin borax, saltpetre, and Glauber-salt, of each ½ oz., and dissolve or wet with soft water sufficient to allow it to be spread on the flesh side of the skin. Put it on with a brush thickest in the centre or thickest part of the skin, and double the skin together, flesh side in; keeping it in a cool place for 24 hours, not allowing it to freeze. Then wash the skin clean, and take sal-soda, 1 oz., borax, ½ oz.; refined soap, 2 oz.; melt them slowly together, being careful not to allow them to boil, and apply the mixture to the flesh side as at first. Boil up again, and keep in a warm place for 24 hours; then wash the skin clean again, as above, and have saleratus, 2 oz., dissolved in hot rain water sufficient to well saturate the skin; take alum, 4 oz.; salt, 8 oz.; and dissolve also in hot rain water; when sufficiently cool to allow the handling of it without scalding, put in the skin for 12 hours; then wring out the water and hang up for 12 hours more to dry. Repeat this last soaking and drying 2 or 3 times, according to the desired softness of the skin when finished. Lastly finish, by pulling and working, and finally by rubbing with a piece of pumice-stone and fine sand-paper. This works like a charm on sheep-skins, fur skins, dog, wolf, bear-skins, &c.

FRENCH POLISH OR DRESSING FOR LEATHER.—Mix 2 pts. best vinegar with 1 pt. soft water; stir into it ¼ lb. glue, broken up, ½ lb. logwood-chips, ¼ oz. of finely powdered indigo, ¼ oz. of the best soft soap, ¼ oz. of isinglass; put the mixture over the fire, and let it boil ten minutes or more; then strain, bottle, and cork. When cold, it is fit for use. Apply with a sponge.

CURRIERS' SIZING.—Take of sizing, 1 qt.; soft soap, 1 gill; stuffing, 1 gill; sweet milk, ½ pt.; boil the sizing in water to a proper consistence, strain, and add the other ingredients; and when thoroughly mixed, it is ready for use.

CURRIERS' PASTE.—*First Coat.*—Take of water, 2 qts.; flour, ½ pint; Castile soap, 1 oz.; make into paste. *Second Coat.*—Take of first paste, ½ pt.; gum tragacanth, 1 gr.; water, 1 pt.; mix all together. This will finish 18 sides of upper.

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CURRIERS' SKIRTING.—This is for finishing skirting and the flesh of harness leather, in imitation of oak tanning. Take of chrome yellow, $\frac{1}{2}$ lb.; yellow ochre, 1 lb.; cream of tartar, 1 oz.; soda, $\frac{1}{2}$ oz.; paste, 5 qts.; mix well. This will finish twelve sides.

SKIRTING.—For the grain to imitate oak tan. Take of chrome yellow, $\frac{1}{2}$ lb.; yellow ochre, $\frac{1}{2}$ lb.; cream of tartar, 1 oz.; soda, 1 oz.; paste, 2 qts.; spirits of turpentine, 1 pt.; mix well. This will finish twelve sides.

DYES FOR LEATHER.—*Blue.*—For each skin, take 1 oz. of indigo, put it into boiling water, and let it stand one night; then warm it a little, and with a brush smear the skin twice over, and finish the same as the red. *Red.*—After the skin has been properly prepared with sheep, pigs' dung, &c., then take strong alum water, and sponge over your skin; when dry, boil a strong gall liquor (it cannot be too strong); then boil a strong Brazil wood liquor (the stronger the better); take a sponge, dip it into your liquor, and sponge it over your skin; repeat this till it comes to a full red. To finish your skin, take the white of eggs, and a little gum dragon, mix the two together in half a gill of water, sponge over your skin, and, when dry, polish off. *Yellow.*—1. Infuse quercitron bark in vinegar, in which put a little alum, and brush over your skins with the infusion; finish the same as the red. 2. Take 1 pt. of whisky; 4 oz. turmeric; mix them well together; when settled, sponge your skins over, and finish as above. *Black.*—Put your skin on a clean board, sponge it over with gall and sumach liquors, strong; then take a strong logwood liquor, sponge it over three or four times; then take a little copperas, mix it in the logwood liquor; sponge it over your skin, and finish it same as the red. *Purple.*—First sponge with the alum liquor strong, then with logwood liquor strong; or mix them both, and boil them, and sponge with the liquor; finish the same as the red. The pleasing hues of yellow, brown, or tan color, are readily imparted to leather by the following simple process: steep saffron in boiling water for a number of hours, wet a sponge or soft brush in the liquor, and with it smear the leather. The quantity of saffron, as well as of water, will of course depend on how much dye may be wanted, and their relative proportions to the depth of color required.

TO MARBLE BOOKS OR PAPER.—Marbling of books or paper is performed thus: Dissolve 4 ounces of gum arabic in 2 quarts of fair water; then provide several colors mixed with water in pots or shells, and with pencils peculiar to each color; sprinkle them by way of intermixture upon the gum water, which must be put into a trough, or some broad vessel; then, with a stick, curl them, or draw them out in streaks to as much variety as may be done. Having done this, hold your book or books close together, and only dip the edges in, on the top of the water and colors, very lightly; which done, take them off, and the plain impression of the colors in mixture will be upon the leaves, doing as well the ends as the front of the books in like manner, and afterwards glazing the colors.

BOOKBINDERS' VARNISH.—Shellac, 8 parts; gum benzoine, 3 parts; gum mastic, 2 parts; br-ise, and digest in alcohol, 48 parts; oil of lavender, $\frac{1}{2}$ part. Or, digest shellac, 4 parts; gum mastic,

2 parts; gum dammer and white turpentine, of each, 1 part; with alcohol (95 per cent.), 28 parts.

RED SPRINKLE FOR BOOKBINDERS' USE.—Brazil wood (ground), 4 parts; alum, 1 part; vinegar, 4 parts; water, 4 parts. Boil until reduced to 7 parts, then add a quantity of loaf sugar and gum; bottle for use. *Blue.*—Strong sulphuric acid, 8 oz.; Spanish indigo, powdered, 2 oz.; mix in a bottle that will hold a quart, and place it in a warm bath to promote solution. For use, dilute a little to the required color in a tea-cup. *Black.*—No better black can be procured than that made by the receipt for edge blacking, in this work, *which see.* *Orange color.*—Ground Brazil wood, 16 parts; annatto, 4 parts; alum, sugar, and gum arabic, each 1 part; water, 70 parts, boil, strain, and bottle. *Purple.*—Logwood chips, 4 parts; powdered alum, 1 part; soft water, 24 parts; boil until reduced to 16 parts, and bottle for use. *Green.*—French berries, 1 part; soft water, 8 parts. Boil, and add a little powdered alum; then bring it to the required shade of green, by adding liquid blue. *Brown.*—Logwood chips, 1 part; annatto, 1 part; boil in water, 6 parts; if too light, add a piece of copperas the size of a pea.

TREE-MARBLE.—A marble in the form of trees may be done by bending the boards a little on the centre, using the same method as the common marble, having the covers previously prepared. The end of a candle may be rubbed on different parts of the board to form knots. *Rice-Marble.*—Color the cover with spirits of wine and turmeric, then place on rice in a regular manner, throw on a very fine sprinkle of copperas water till the cover is nearly black, and let it remain till dry. The cover may be spotted with the red liquid or potash-water, very freely, before the rice is thrown off the boards. *Spotted Marble for Books, etc.*—After the fore-edge of the book is cut, let it remain in the press, and throw on linseeds in a regular manner, sprinkle the edge with any dark color till the paper is covered, then shake off the seeds. Various colors may be used; the edge may be colored with yellow or red before throwing on the seeds, and sprinkling with blue. The seeds will make a fine fancy edge when placed very thick on different parts, with a few slightly thrown on the spaces between. *Japan Coloring for Leather, Book-covers, etc.*—After the book is covered and dry, color the cover with potash-water mixed with a little paste: give 2 good coats of Brazil wash, and glaze it; put the book between the hands, allowing the boards to slope a little; dash on copperas-water, then with a sponge full of red liquid press out on the back and on different parts large drops, which will run down each board and make a fine shaded red; when the cover is dry, wash it over 2 or three times with Brazil wash to give it a brighter color. (*See the various dyes for leather.*)

GOLD SPRINKLE FOR BOOKS.—Put in a marble mortar $\frac{1}{2}$ oz. pure honey and one book of gold leaf, rub them well together until they are very fine, add $\frac{1}{2}$ pint clear water, and mix well together when the water clears, pour it off, and put in more till the honey is all extracted, and nothing remains but the gold; mix one grain of corrosive sublimate in a teaspoonful of spirits of wine, and when dissolved, put the same, together with a little guma water, to the

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gold, and bottle for use. The edges of the book may be sprinkled or colored very dark, with green, blue, or purple, and lastly with the gold liquid in small or large spots, very regular, shaking the bottle before using. Burnish the edges when dry, and cover them with paper to prevent the dust falling thereon. This sprinkle will have a most beautiful appearance on extra work.

TO GILD THE EDGES OF BOOKS.—Armenian bole, 4 parts, sugar candy, 1 part, white of egg to mix. Apply this composition to the edge of the leaves, previously firmly screwed in the cutting-press; when nearly dry, smooth the surface with the burnisher; then take a damp sponge and pass over it, and with a piece of cotton-wool, take the leaf from the cushion and apply it to the work; when quite dry, burnish, observing to place a piece of silver or India paper between the gold and the agate.

CHINESE EDGE FOR BOOKS.—Color the edge with light liquid blue and dry; then take a sponge charged with vermilion, and dab on spots according to fancy; next throw on rice, and finish the edge with dark liquid blue.

DYES FOR FEATHERS.—*Green Dye.*—Take of verdigris and verditer, of each, 1 oz.; gum-water, 1 pt.; mix them well, and dip the bristles, fur, or feathers, they having been first soaked in hot water, into the said mixture. *Blue.*—Take of Indigo and risse, each, 1 oz.; and a piece of alum the size of a hazel nut; put them into gum-water, and dip the materials into it hot; hang them up to dry, and clap them well that they may open; and, by changing the colors, the aforesaid materials may be in this manner dyed of any color. For *purple*, use lake and indigo; for *carnation*, vermilion and smalt. *Red.*—Take an ounce of Brazil wood in powder; $\frac{1}{2}$ oz. of alum; vermilion, $\frac{1}{2}$ oz.; and a pint of vinegar; boil them up to a moderate thickness, and dip the fur or feathers, they having been first soaked in hot water, into the said mixture. For *black*, use the same as for cloth. (See "Receipts for Dyeing.") *Yellow.*—Mordant with acetate of alumina, and dip in a bath of turmeric or weld. *Crimson.*—Dip in acetate of alumina mordant, then in a boiling hot decoction of Brazil wood, and, last of all, pass through a bath of cudbear.

TO MAKE PAPER INTO PARCHMENT.—To produce this transformation, take unsized paper and plunge it into a solution of two parts of concentrated sulphuric acid combined with 1 part water; withdraw it immediately, and wash it in clean water, and the change is complete. It is now fit for writing; for the acid supplies the want of size, and it becomes so strong that a strip 2 or 3 inches wide will bear from 60 to 80 lbs. weight, while a like strip of parchment will bear only about 25 lbs.

HORN IN IMITATION OF TORTOISE-SHELL.—First steam and then press the horn into proper shapes, and afterwards lay the following mixture on with a small brush, in imitation of the mottle of tortoise-shell: Take equal parts of quick lime and litharge, and mix with strong soap-lees; let this remain until it is thoroughly dry; brush off, and repeat two or three times if necessary. Such parts as are required to be of a reddish brown should be covered with a mixture of whiting and the stain.

DYES FOR IVORY, HORN, AND BONE.—*Black*.—1. Lay the articles for several hours in a strong solution of nitrate of silver, and expose to the light. 2. Boil the article for some time in a strained decoction of logwood, and then steep it in a solution of per-sulphate or acetate of iron. 3. Immerse frequently in ink until of sufficient depth of color. *Blue*.—1. Immerse for some time in a dilute solution of sulphate of indigo, partly saturated with potash, and it will be fully stained. 2. Steep in a strong solution of sulphate of copper. *Green*.—1. Dip blue-stained articles for a short time in nitro-hydrochlorate of tin, and then in a hot decoction of fustic. 2. Boil in a solution of verdigris in vinegar until the desired color is obtained. *Red*.—1. Dip the articles first in a tin mordant, used in dyeing, and then plunge into a hot decoction of Brazil wood— $\frac{1}{2}$ lb. to a gallon of water—or cochineal. 2. Steep in red ink till sufficiently stained. *Scarlet*.—Use lac dye instead of the preceding. *Violet*.—Dip in the tin mordant, and then immerse in a decoction of logwood. *Yellow*.—Boil the articles in a solution of alum, 1 lb. to $\frac{1}{2}$ a gallon, then immerse for half an hour in the following mixture: Take $\frac{1}{2}$ lb. of turmeric, and $\frac{1}{4}$ lb. of pearl-ash; boil in 1 gal. water: when taken from this, the bone must be again dipped in the alum solution.

ETCHING FLUID FOR IVORY.—Take dilute sulphuric acid, dilute muriatic acid, equal parts: mix. For etching varnish take white wax, 2 parts; tears of mastic, 2 parts: mix.

TO GILD IVORY.—Immerse it in a solution of nitro-muriate of gold, and then expose it to hydrogen gas while damp. Wash it afterwards in clean water.

TO SOFTEN IVORY.—In 3 oz. spirits of nitre and 15 oz. of spring-water, mixed together, put your Ivory to soak; and in three or four days it will obey your fingers.

TO WHITEN IVORY.—Slack some lime in water; put your ivory in the water, after being decanted from the grounds, and boil it till it looks quite white. To polish it afterwards, set it in the turner's wheel; and, after having worked, take rushes and pumice-stones, subtile powder, with water, and rub it till it looks perfectly smooth. Next to that, heat it by turning it against a piece of linen or sheep-skin leather: and when hot, rub it over with a little dry whitening diluted in oil of olive; then with a little dry whitening alone; finally with a piece of soft white rag. When all this is performed as directed, the ivory will look very white.

ANOTHER WAY TO BLEACH IVORY.—Take 2 handfuls of lime, slake it by sprinkling it with water: then add 3 pts. of water, and stir the whole together; let it settle ten minutes, and pour the water into a pan for your purpose. Then take your ivory and steep it in the lime-water for 24 hours, after which, boil it in a strong alum-water 1 hour, and dry it in the air.

ADDITIONAL DYES FOR FEATHERS.—*Black*: immerse for 2 or 3 days in a bath, at first hot, of logwood, 8 parts, and copperas or acetate of iron, 1 part. *Blue*: with the indigo vat. *Brown*: by using any of the brown dyes for silk or woollen. *Crimson*: a mordant of alum, followed by a hot bath of Brazil wood, afterwards by a weak dye of cudbear. *Pink* or *Rose*: with safflower or lemon juice. *Plum*: with the red dye, followed by an alkali-

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line bath. *Red*: a mordant of alum, followed by a bath of Brazil wood. *Yellow*: a mordant of alum, followed by a bath of turmeric or weld.

COLORS FOR ARTIFICIAL FLOWERS.—The French employ *velvet*, *fine cambric*, and *kid* for the *petals*, and *taffeta* for the leaves. Very recently thin plates of *bleached whalebone* have been used for some portions of the artificial flowers. *Colors and Stains. Blue*.—Indigo dissolved in oil of vitriol, and the acid partly neutralized with salt of tartar or whiting. *Green*.—A solution of distilled verdigris. *Lilac*.—Liquid archil. *Red*.—Carmine dissolved in a solution of salt of tartar, or in spirits of hartshorn. *Violet*.—Liquid archil mixed with a little salt of tartar. *Yellow*.—Tincture of turmeric. The colors are generally applied with the fingers.

TO CUT AND POLISH MARBLE.—The marble saw is a thin plate of soft iron, continually supplied, during its sawing motion, with water and the sharpest sand. The sawing of moderate pieces is performed by hand: that of large slabs is most economically done by a proper mill. The first substance used in the polishing process is the sharpest sand, which must be worked with till the surface becomes perfectly flat. Then a second and even a third sand, of increasing fineness, is to be applied. The next substance is emery, of progressive degrees of fineness; after which, tripoli is employed; and the last polish is given with tin putty. The body with which the sand is rubbed upon the marble is usually a plate of iron; but, for the subsequent process, a plate of lead is used, with fine sand and emery. The polishing-rubbers are coarse linen cloths, or bagging, wedged tight into an iron planing tool. In every step of the operation, a constant trickling supply of water is required.

ALABASTER, MARBLE, OR STONE may be stained of a yellow, red, green, blue, purple, black, or any of the compound colors, by the stains used for wood.

POWERFUL CEMENT FOR BROKEN MARBLE.—Take gum arabic, 1 lb.; make into a thick mucilage: add to it powdered plaster of Paris, 1½ lb.; sifted quick lime, 5 oz.; mix well; heat the marble, and apply the mixture.

SEVEN COLORS FOR STAINING MARBLE.—It is necessary to heat the marble hot, but not so hot as to injure it, the proper heat being that at which the colors nearly boil. *Blue*; alkaline indigo dye, or turnsole with alkali. *Red*; dragon's blood in spirits of wine. *Yellow*; gamboge in spirits of wine. *Gold Color*; sal-ammoniac, sulphate of zinc, and verdigris, equal parts. *Green*; sap green, in spirits of potash. *Brown*; tincture of logwood. *Crimson*; alkanet root in turpentine. Marble may be veined according to taste. To stain marble well is a difficult operation.

PERPETUAL INK FOR TOMBSTONES, ETC.—Pitch, 11 lbs.; lampblack, 1 lb.; turpentine sufficient; mix with heat.

TO CLEAN OLD MARBLE.—Take a bullock's gall, 1 gill soap lees, half a gill of turpentine; make into a paste with pipeclay, apply it to the marble; let it dry a day or two, then rub it off, and it will appear equal to new; if very dirty, repeat the application.

TO EXTRACT OIL FROM MARBLE OR STONE.—Soft soap, 1 part; fullers earth, 2 parts; potash, 1 part; boiling water to mix. Lay it on the spots of grease, and let it remain for a few hours.

TO CLEAN MARBLE.—Take two parts of common soda, 1 part pumice stone, and 1 part of finely powdered chalk; sift it through a fine sieve, and mix it with water; then rub it well all over the marble, and the stains will be removed; then wash the marble over with soap and water, and it will be as clean as it was at first.

TO MAKE A CHEMICAL BAROMETER.—Take a long, narrow bottle, and put into it 2½ drs. of camphor; spirits of wine, 11 drs. When the camphor is dissolved, add to it the following mixture: water, 9 drs.; saltpetre, 38 grs.; sal-ammoniac, 38 grs. Dissolve these salts in the water prior to mixing with the camphorated spirit; then shake all well together, cork the bottle well, wax the top, but afterwards make a very small aperture in the cork with a red-hot needle. By observing the different appearances which the materials assume as the weather changes, it becomes an excellent prognosticator of a coming storm or of a sunny sky.

PRINTER'S ROLLERS are made of glue and molasses, with sometimes a little Spanish white. The proportions are 1 lb. glue to 1 pint molasses. Break the glue to pieces, soak for 24 hours, then melt the molasses, and cast in a mould previously oiled to prevent it from sticking. When it gets hard after long use, remelt it, using a little more molasses.

SAVAGE'S PRINTING INK.—Pure balsam of copaiba, 9 oz.; lamp-black, 3 oz.; indigo and Prussian blue, each 5 drams; Indian red, ¼ oz.; yellow soap, 3 oz. Mix, and grind to the utmost smoothness.

TRAPPER'S AND ANGLER'S SECRET FOR GAME AND FISH.—A few drops of oil of anise, or oil rhodium, on any trapper's bait, will entice any wild animal into the snare trap. India cockle mixed with flour dough, and sprinkled on the surface of still water, will intoxicate fish, rendering them insensible; when coming up to the surface, they can be lifted into a tub of fresh water to revive them, when they may be used without fear.

RECEIPTS FOR CABINETMAKERS, PAINTERS, GILDERS, BRONZERS, GLASS STAINERS, &C.

CHEAP BLACK WALNUT STAIN.—Burnt umber, 2 parts, rose pink, 1 part, glue, 1 part, water sufficient; heat all together and dissolve completely, apply to the work first with a sponge, then go over it with a brush, and varnish over with shellac.

EBONY STAIN.—Drop black, 2 parts, rose pink, 1 part, turpentine a sufficient quantity.

BRIGHT YELLOW STAIN.—1. Brush over with the tincture of turmeric. 2. Warm the work, and brush it over with weak aquafortis varnish or oil as usual. 3. A very small bit of aloes put into the varnish will give a rich yellow color to the wood.

EXTRA BLACK STAIN FOR WOOD.—Pour 2 quarts boiling water over 1 oz. of powdered extract of logwood, and, when the solution is effected, 1 dr. of yellow chromate of potash is added, and the whole well stirred. It is then ready for use as a wood-stain, or for

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writing ink. When rubbed on wood, it produces a pure black. Repeat with 2, 3, or 4 applications, till a deep black is produced, which acquires the highest beauty when polished or stained.

IMITATION OF MAHOGANY.—Let the first coat of painting be white lead, the second, orange, and the last, burnt umber or sienna: imitating the veins according to your taste and practice.

TO IMITATE WAINSCOT.—Let the first coat be white; the second, half white and half yellow ochre; and the third, yellow ochre only: shadow with umber or sienna.

TO IMITATE SATIN WOOD.—Take white for your first coating, light blue for the second, and dark blue or dark green for the third.

ROSEWOOD SATIN, VERY BRIGHT SHADE.—USED COLD.—Take alcohol. 1 gal; camwood, 2 oz; set them in a warm place 24 hours; then add extract of logwood, 3 oz.; aquafortis, 1 oz.; and when dissolved, it is ready for use; it makes a very bright ground like the most beautiful rosewood; 1, 2, or more coats as you desire, over the whole surface.

VARNISH FOR FRAMES, ETC.—Lay the frames over with tin or silver foil by means of plaster of Paris, glue or cement of some kind, that the foil may be perfectly adherent to the wood; then apply your gold lacquer varnish, which is made as follows: Ground turmeric, 1 lb; powdered gamboge, $1\frac{1}{2}$ ounces; powdered sandarach, $3\frac{1}{2}$ lbs; powdered shellac, $\frac{3}{4}$ lbs.; spirits of wine, 2 gals.; dissolve and strain; then add turpentine varnish, 1 pt.; and it is ready for use.

CHERRY STAIN.—Rain water, 3 qts.; annotto, 4 oz.; boil in a copper kettle till the annotto is dissolved, then put in a piece of potash the size of a walnut; keep it on the fire about half an hour longer, and it is ready to bottle for use.

ROSEWOOD STAIN, LIGHT SHADE.—Equal parts of logwood and red-wood chips, boil well in water sufficient to make a strong stain; apply it to the furniture while hot; 2 or 3 coats according to the depth of color desired.

ROSE PINK STAIN AND VARNISH.—Put 1 oz. of potash in 1 qt. water, with red sanders, $1\frac{1}{2}$ oz.; extract the color from the wood and strain; then add gum shellac, $\frac{1}{2}$ lb., dissolve it by a brisk fire. Used upon logwood stain for rosewood imitation.

BLUE STAIN FOR WOOD.—1. Dissolve copper filings in aquafortis, brush the wood with it, and then go over the work with a hot solution of pearlash (2 oz. to 1 pt. of water) till it assumes a perfectly blue color. 2. Boil 1 lb of indigo, 2 lbs. wood, and 3 oz. alum, in 1 gal. water. brush well over until thoroughly stained.

IMITATION OF BOTANY-BAY WOOD.—Boil $\frac{1}{2}$ lb. French berries (the unripe berries of the *Rhamnus infectarius*) in 2 qts. water till of a deep yellow, and while boiling hot, give 2 or 3 coats to the work. If a deeper color is desired, give a coat of logwood decoction over the yellow. When nearly dry, form the grain with No. 8, black stain, used hot, and, when dry, rust and varnish.

MAHOGANY COLOR—DARK.—1. Boil $\frac{1}{2}$ lb. of madder and 2 oz. logwood-chips in a gallon of water, and brush well over while hot; when dry go over the whole with pearlash solution, 2 drs. to the quart. 2 Put 2 oz. dragon's blood, bruised, into a quart of oil of

turpentine; let the bottle stand in a warm place, shake frequently, and, when dissolved, steep the work in the mixture.

BOX-WOOD BROWN STAIN.—Hold your work to the fire, that it may receive a gentle warmth; then take aquafortis, and, with a feather, pass it over the work till you find it change to a fine brown (always keeping it near the fire); you may then varnish or polish it.

LIGHT RED BROWN.—Boil $\frac{1}{2}$ lb. madder and $\frac{1}{2}$ lb. fustic in 1 gal. water; brush over the work, when boiling hot, until properly stained. 2. The surface of the work being quite smooth, brush over with a weak solution of aquafortis, $\frac{1}{2}$ oz. to the pint; then finish with the following:—Put $4\frac{1}{2}$ oz. dragon's blood and 1 oz. soda, both well bruised, to 3 pts. spirits of wine, let it stand in a warm place, shake frequently, strain and lay on with a soft brush, repeating until of a proper color: polish with linseed oil or varnish.

PURPLE.—Brush the work several times with the logwood decoction used for No. 6, *Black*; and, when dry, give a coat of pearlash solution, 1 dr. to a quart: lay it on evenly.

RED.—1. Boil 1 lb. Brazil wood and 1 oz. pearlash in a gal. of water; and, while hot, brush over the work until of a proper color. Dissolve 2 oz. alum in 1 qt. water, and brush the solution over the work before it dries. 2. Take a gallon of the above stain, add 2 oz. more pearlash; use hot, and brush over with the alum solution. 3. Use a cold solution of archil, and brush over with the pearlash solution for No. 1, *Dark mahogany*.

MAHOGANY STAIN ON WOOD.—Take nitric acid, dilute with 10 parts of water, and wash the wood with it. To produce *rosewood* finish, glaze the same with carmine or Munich lake. Asphaltum, thinned with turpentine, forms an excellent mahogany color on new work.

BEAUTIFUL VARNISH FOR VIOLINS, &C.—Rectified spirits of wine, $\frac{1}{2}$ gal.; add 6 oz. gum sandarach, 3 oz. gum mastic, and $\frac{1}{2}$ pt. turpentine varnish; put the above in a tin can by the stove, frequently shaking till well dissolved: strain and keep for use. If you find it harder than you wish, thin with more turpentine varnish.

ANOTHER.—Heat together at a low temperature 2 qts. of alcohol, $\frac{1}{2}$ pt. turpentine varnish, and 1 lb. clean gum mastic; when the latter is thoroughly dissolved, strain through a cloth.

CRIMSON STAIN FOR MUSICAL INSTRUMENTS.—Ground Brazil wood, 1 lb.; water, 3 qts.; cochineal, $\frac{1}{2}$ ounce; boil the Brazil with the water for an hour, strain, add the cochineal: boil gently for half an hour, when it will be fit for use. If you wish a *scarlet tint*, boil an ounce of saffron in a quart of water, and pass over the work before you stain it.

PURPLE STAIN.—Chipped logwood, 1 lb.; water, 3 qts.; pearlash, 4 ounces; powdered indigo, 2 ounces. Boil the logwood in the water half an hour, add the pearlash and indigo, and when dissolved, you will have a beautiful purple.

GREEN STAIN.—Strong vinegar, 3 pts.; best verdigris, 4 ounces, ground fine; sap green, $\frac{1}{2}$ ounce: mix together.

BLACK STAINS FOR WOOD.—1. Drop a little sulphuric acid into a small quantity of water; brush over the wood and hold it to the fire, it will be a fine black and receive a good polish. 2. For a beautiful black, on wood, nothing can exceed the *black Japan* mentioned

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under Tinsmith's Department. Apply two coats; after which, varnish and polish it. 3. To 1 gal vinegar, add a quarter of a pound of iron rust; let it stand for a week: then add a pound of dry lampblack, and three-quarters of a pound copperas; stir it up for a couple of days. Lay on five or six coats with a sponge, allowing it to dry between each; polish with linseed-oil and a soft woollen rag, and it will look like ebony. Incomparable for iron work, ships' guns, shot, &c. 4. Vinegar, $\frac{1}{2}$ gal.; dry lampblack, $\frac{1}{2}$ lb.; iron-rust sifted, 3 lbs.; mix and let stand for a week. Lay three coats of this on hot, and then rub with linseed oil, and you will have a fine deep black. 5. Add to the above stain, nut-galls, 1 oz.; logwood-chips, $\frac{1}{2}$ lb.; copperas, $\frac{1}{2}$ lb.; lay on three coats; oil well, and you will have a black stain that will stand any kind of weather, and is well adapted for ships' combings, &c. 6. Logwood-chips, $\frac{1}{2}$ lb.; Brazil-wood, $\frac{1}{2}$ lb.; boil for $1\frac{1}{2}$ hours in 1 gal. water. Brush the wood with this decoction while hot; make a decoction of nut-galls, by simmering gently, for three or four days, a quarter of a pound of the galls in 3 qts. water; give the wood three coats, and, while wet, lay on a solution of sulphate of iron (2 oz to a quart), and, when dry, oil or varnish. 7. Give three coats with a solution of copper filings in aquafortis, and repeatedly brush over with the logwood decoction until the greenness of the copper is destroyed. 8. Boil $\frac{1}{2}$ lb logwood-chip in 2 quarts water; add an ounce of pearlash, and apply hot with a brush. Then take 2 qts. of the logwood decoction, and $\frac{1}{2}$ oz. of verdigris and the same of copperas; strain, and throw in $\frac{1}{2}$ lb of iron rust. Brush the work well with this, and oil.

MISCELLANEOUS STAINS.—*Yellow* is produced by diluted nitric acid. *Red* is produced by a solution of dragon's blood in spirits of wine. *Black* is produced by a strong solution of nitric acid. *Green* is produced by a solution of verdigris in nitric acid; then, dipped in a hot solution of pearlash produces a *Blue stain*. *Purple* is produced by a solution of sal-ammoniac in nitric acid.

FINISHING WITH ONE COAT OF VARNISH.—*Valuable Process*—Give the furniture a coat of boiled linseed oil, then immediately sprinkle dry whiting upon it, and rub it in well with your hand or a stiff brush, all over the surface; the whiting absorbs the oil, and fills the pores of the wood completely. For black walnut, add a little burned umber to the whiting; for cherry, a little Venetian red, &c, according to the color of the wood. Turned work can have it applied while in motion in the lathe. Furniture can afterwards be finished with only one coat of varnish.

MAHOGANY STAIN ON MAPLE.—Dragon's blood, $\frac{1}{2}$ oz.; alkanet, $\frac{1}{2}$ oz.; aloes, 1 dr.; spirits of wine, 16 oz.; apply it with a sponge or brush.

TO POLISH WOOD.—Take a piece of pumice-stone and water, and pass repeatedly over the work until the rising of the grain is cut down. Then take powdered tripoli and boiled linseed oil, and polish the work to a bright surface.

CLOCK CASE AND PICTURE FRAME FINISH.—Copal varnish, 2 lbs.; linseed oil varnish, $\frac{1}{2}$ oz.; mix well, shake often, and place in a warm spot. The wood to be varnished is prepared with a thin coat of glue-water, and rubbed down with fine pumice-stone or some-

thing equivalent. In light-colored wood, a light pigment, such as chalk, is added to the glue-water; in dark wood, a dark pigment is added. When ready, the articles are varnished with the above mixture, and, after drying, rubbed with a solution of wax in ether thereby receiving a high polish.

FANCY FIGURES ON WOOD—Slack some lime in stale urine. Dip a brush in it, and form on the wood figures to suit your fancy. When dry, rub it well with a rind of pork.

BLACK WALNUT POLISH.—Take pulverized asphaltum; put it in a jar or bottle, pour over it about twice its bulk of turpentine or benzole, put in a warm place, and shake occasionally; when dissolved, strain, and apply it to the wood with a cloth or stiff brush; should it prove too dark, dilute with turpentine or benzole. If desired to bring out the grain still more, apply a mixture of boiled oil and turpentine; this is better than oil alone. When the oil is dry, the wood can be polished with the following Shellac varnish, 2 parts boiled oil, 1 part. shake it well before using. Apply with a cloth, rubbing briskly.

POLISHES.—1 *Curvers' Polish.*—White resin, 2 oz., seed lac, 2 oz.; spirits of wine, 1 pt. Dissolve. It should be laid on warm. Avoid moisture and dampness when used. 2 *French Polish.*—Gum shellac, 1 oz.; gum arabic, $\frac{1}{2}$ oz.; gum copal, $\frac{1}{2}$ oz. Powder, and sift through a piece of muslin; put them in a closely corked bottle with 1 pt. spirits of wine, in a very warm situation, shaking every day till the gums are dissolved; then strain through muslin, and cork for use. 3 *Polish for Dark-colored Woods.*—Seedlac, 1 oz.; gum guaiacum, 2 drs.; dragon's blood, 2 drs.; gum mastic, 2 drs.; put in a bottle with 1 pt. spirits of wine, cork close, expose to a moderate heat till the gums are dissolved; strain into a bottle for use, with $\frac{1}{2}$ gill of linseed oil. shake together. 4 *Waterproof Polish.*—Gum benjamin, 2 oz.; gum sandarach, $\frac{1}{2}$ oz.; gum anima, $\frac{1}{2}$ oz.; spirits of wine, 1 pt.; mix in a closely stopped bottle, and place either in a sand bath or in hot water till the gums are dissolved, then strain off the mixture, shake it up with $\frac{1}{2}$ gill of the best clear poppy oil, and put it by for use. 5 *Finishing Polish.*—Gum shellac, 2 drs.; gum benjamin, 2 drs.; put into $\frac{1}{2}$ pt. of best rectified spirits of wine in a bottle closely corked; keep in a warm place, shaking frequently till the gums are dissolved. When cold, shake up with it two teaspoonfuls of the best clear poppy oil.

POLISH FOR REMOVING STAINS, SPOTS, AND MILDEW FROM FURNITURE.—Take of 98 per cent alcohol, $\frac{1}{2}$ pint.; pulverised rosia and gum shellac, of each, $\frac{1}{2}$ oz. Let these cut in the alcohol; then add linseed oil, $\frac{1}{2}$ pt.; shake well, and apply with a sponge, brush, or cotton flannel, or an old newspaper, rubbing it well after the application, which gives a nice polish.

POLISH FOR REVIVING OLD FURNITURE.—Take alcohol, $1\frac{1}{2}$ oz., spirits of salts (muriatic acid), $\frac{1}{2}$ oz.; linseed oil, 8 oz.; best vinegar, $\frac{1}{2}$ pt.; and butter of antimony, $1\frac{1}{2}$ oz.; mix, putting in the vinegar last.

JET OR POLISH FOR WOOD OR LEATHER, BLACK, RED, OR BLUE.—Alcohol (98 per cent.), 1 pt., sealing wax, the color desired, 3 sticks; dissolve by heat, and have it warm when applied. A sponge is the best to apply it with.

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POLISH FOR TURNERS' WORK.—Dissolve sandarach, 1 oz., in spirit of wine, $\frac{1}{2}$ pt.; next shave bees'-wax, 1 oz.; and dissolve it in a sufficient quantity of spirits of turpentine to make it into a paste; add the former mixture by degrees to it, then with a woollen cloth apply it to the work while it is in motion in the lathe, and with a soft linen rag polish it. It will appear as if highly varnished.

FURNITURE POLISH.—Bees'-wax, $\frac{1}{2}$ lb., and $\frac{1}{4}$ of an oz. of alkanet root; melt together in a pipkin until the former is well colored. Then add linseed oil and spirits of turpentine, of each half a gill; strain through a piece of coarse muslin.

FRENCH POLISHES.—1. Shellac, 3 lbs.; wood naphtha, 3 pts.; dissolve. 2. Shellac, 2 lbs.; powdered mastic and sandarach, of each 1 oz.; copal-varnish, $\frac{1}{2}$ pint; spirits of wine, 1 gal. Digest in the cold till dissolved.

OIL FINISH.—1. Linseed oil, 16 oz.; black rosin, 4 oz.; vinegar, 4 oz. rectified spirits, 3 oz.; butter of antimony, 10 oz.; spirit of salts, 2 oz.; melt the rosin, add the oil, take it off the fire, and stir in the vinegar; let it boil for a few minutes, stirring it; when cool, put it into a bottle, add the other ingredients, shaking all together. 2. Linseed oil, 1 pt.; oil of turpentine, $\frac{1}{2}$ pt.; rectified spirit, 4 ozs.; powdered rosin, $1\frac{1}{2}$ oz.; rose pink, $\frac{1}{2}$ oz.; mix.

FURNITURE PASTES.—1. Bees'-wax, spirits of turpentine, and linseed oil, equal parts; melt and cool. 2. Bees'-wax, four ounces; turpentine, 10 oz.; alkanet root, to color; melt and strain. 3. Bees'-wax, 1 lb.; linseed oil, 5 oz.; alkanet root, $\frac{1}{2}$ oz.; melt, and add 5 oz. of turpentine; strain and cool. 4. Bees'-wax, 4 oz.; resin, 1 oz.; oil of turpentine, 2 oz.; Venetian red, to color.

FURNITURE PASTE.—1. Turpentine, 1 pt.; alkanet root, $\frac{1}{2}$ oz.; digest until sufficiently colored, then add bees'-wax, scraped small, 4 oz.; put the vessel into hot water, and stir till dissolved. If wanted *pale*, the alkanet root should be omitted. 2. (*White*.) White wax, 1 lb.; liquor of potassa, $\frac{1}{2}$ gal.; boil to a proper consistence. 3. Bees'-wax, 1 lb.; soap, $\frac{1}{2}$ lb.; pearlash, 3 oz. (dissolved in water, $\frac{1}{2}$ gal., and strained); boil as last. 4. Yellow wax, 18 parts; resin, 1 part; alkanet root, 1 part; turpentine, 6 parts; linseed oil, 6 parts. First steep the alkanet in the oil with heat, and, when well colored, pour off the clear on the other ingredients, and again heat till all are dissolved.

FURNITURE CREAM.—Bees'-wax, 1 lb.; soap, 4 oz.; pearlash, 2 oz.; soft water, 1 gal.; boil together until mixed.

FURNITURE OILS.—1. Acetic acid, 2 drs.; oil of lavender, $\frac{1}{4}$ dr.; rectified spirit, 1 dr.; linseed oil, 4 oz. 2. Linseed oil, 1 pt.; alkanet root, 2 oz.; heat, strain, and add lac varnish, 1 oz. 3. Linseed oil, 1 pt.; rectified spirit, 2 oz.; butter of antimony, 4 oz. 4. Linseed oil, 1 gal.; alkanet-root, 3 oz.; rose pink, 1 oz. Boil them together ten minutes, and strain so that the oil be quite clear.

WOOD-FILLING COMPOSITION.—Boiled linseed oil, 1 qt.; turpentine, 3 qts.; corn starch, 5 lbs.; Japah, 1 qt.; calcined magnesia, 2 oz. Mix thoroughly.

IMPROVED WOOD-FILLING COMPOSITION.—Whitening, 6 oz.; Japan, $\frac{1}{2}$ pt.; boiled linseed oil, $\frac{1}{2}$ pt.; turpentine, $\frac{1}{2}$ pt.; corn starch, 1 oz. Mix well together and apply to the wood. On walnut wood

add a little burned umber, on cherry a little Venetian red, to the above mixture.

DYES FOR VENEERS.—*A fine Black.*—Put 6 lbs. of logwood chips into your copper, with as many veneers as it will hold without pressing too tight, fill it with water, let it boil slowly for about 3 hours, then add $\frac{1}{2}$ lb. of powdered verdigris, $\frac{1}{2}$ lb. copperas, bruised gall-nuts, 4 oz.; fill the copper up with vinegar as the water evaporates; let it boil gently 2 hours each day till the wood is dyed through. *A fine Blue.*—Put oil of vitriol, 1 lb., and 4 oz. of the best powdered indigo, in a glass bottle. Set it in a glazed earthen pan, as it will ferment. Now put your veneers into a copper or stone trough; fill it rather more than one-third with water, and add as much of the vitriol and indigo (stirring it about) as will make fine blue, testing it with a piece of white paper or wood. Let the veneers remain till the dye has struck through. Keep the solution of indigo a few weeks before using it; this improves the color. *Fine Yellow.*—Reduce 4 lbs. of the root of barberry to dust by sawing, which put in a copper or brass trough; add turmeric, 4 oz.; water, 4 gals.; then put in as many white holly veneers as the liquor will cover. Boil them together for 3 hours, often turning them. When cool, add aquafortis, 2 oz., and the dye will strike through much sooner. *Bright Green.*—Proceed as in the previous receipt to produce a yellow; but, instead of aquafortis, add as much of the vitriolated indigo (see above, under blue dye) as will produce the desired color. *Bright Red.*—Brazil dust, 2 lbs.; add water, 4 gals. Put in as many veneers as the liquid will cover; boil them for 3 hours, then add alum, 2 oz., aquafortis, 2 oz.; and keep it luke-warm until it has struck through. *Purple.*—To 2 lbs. of chip logwood and $\frac{1}{2}$ lb. Brazil dust, add 4 gals. of water; and after putting in your veneers, boil for 3 hours; then add pearlash, 6 oz., and alum, 2 oz.; let them boil for 2 or 3 hours every day till the color has struck through. *Orange.*—Take the veneers out of the above yellow dye, and while still wet and saturated, transfer them to the bright red dye till the color penetrates throughout.

TO IMPROVE THE COLOR OF STAINS.—Nitric acid, 1 oz.; muriatic acid, $\frac{1}{2}$ teaspoonful; grain tin, $\frac{1}{4}$ oz.; rain water, 2 oz. Mix it at least 2 days before using, and keep your bottle well corked.

STRONG GLUE FOR INLAYING OR VENEERING.—Select the best light brown glue, free from clouds and streaks. Dissolve this in water, and to every pint add half a gill of the best vinegar and $\frac{1}{2}$ oz. of isinglass.

INLaid MOTHER OF PEARL WORK, on sewing machines and other fancy work, is performed by selecting the thin scales of the shell and cementing them to the surface of the material; the rest of the surface is covered with successive coats of Japan varnish, generally black, being subjected to a baking process after each application. When the varnish is as thick as the shell, it is polished, the gilding and painting added, and a flowing coat of varnish put over the whole.

ANOTHER METHOD.—Prepare the job with a heavy coat of black Japan; then, before it is dry, procure some flakes of pearl and lay them on the black surface, pressing them into the Japan until they are level with the surface; then with colors form vines and flowers,

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COMPOUND COLORS.—*Light Gray* is made by mixing white lead with lamp black, using more or less of each material, as you wish to obtain a lighter or darker shade. *Buff* is made from yellow ochre and white lead. *Silver or Pearl Gray*.—Mix white lead, Prussian blue, and a very slight portion of black, regulating the quantities you wish to obtain. *Flaxen Gray* is obtained by a mixture of white lead and Prussian blue, with a small quantity of lake.

Brick Color.—Yellow ochre and red lead, with a little white. *Oak*

Wood Color.—½ white lead and ¼ part umber and yellow ochre,

proportions of the last two ingredients being determined by the desired tints. *Walnut-tree Color*.—½ white lead, and ¼ red ochre,

yellow ochre, and umber, mixed according to the shade sought. If

veining is required, use different shades of the same mixture, and

for the deepest places, black. *Jonquil*.—Yellow, pink, and white

lead. This color is only proper for distemper. *Lemon Yellow*.—

Realgar and orpiment. The same color can be obtained by mixing

yellow pink with Naples yellow; but it is then only fit for distem-

per. *Orange Color*.—Red lead and yellow ochre. *Violet Color*.—

Vermilion, or red lead, mixed with black or blue, and a small por-

tion of white. Vermilion is preferable to red lead in mixing this

color. *Purple*.—Dark-red mixed with violet color. *Carnation*.—

Lake and white. *GOLD COLOR*.—Massicot, or Naples yellow, with

a small quantity of realgar, and a very little Spanish white. *Olive*

Color may be obtained by black and a little blue, mixed with yel-

low. Yellow-pink, with a little verdigris and lampblack; also

ochre and a small quantity of white will produce an olive color.

For distemper, indigo and yellow-pink, mixed with white lead or

Spanish white, must be used. If veined, it must be done with umber.

Lead Color.—Prussian blue and white. *Chestnut Color*.—Red ochre

and black, for a dark chestnut. To make it lighter, employ a mix-

ture of yellow ochre. *Light Timber Color*.—Spruce ochre, white,

and a little umber. *Flesh Color*.—Lake, white lead, and a little

vermilion. *Light Willow Green*.—White, mixed with verdigris.

Grass Green.—Yellow-pink, mixed with verdigris. *Stone Color*.—

White, with a little spruce ochre. *Dark Lead Color*.—Black and

white, with a little Prussian blue. *Fawn Color*.—White lead, stone

ochre, with a little vermilion. *Chocolate Color*.—Lampblack and

Spanish brown. On account of the fatness of lampblack, mix some

litharge and red lead. *Portland Stone Color*.—Umbre, yellow ochre,

and white lead. *Rose Color*.—White lead and carmine or lake.

Salmon Color.—White lead and blue, yellow, and red. *Pearl Color*.

—White lead, Prussian blue, and red. *Slate Color*.—White lead,

black, red and blue. *Pea Green*.—White lead and chrome, or Paris

green. *Cream Color*.—White lead, yellow and red. *Straw Color*.

—White lead and yellow. *Peach Blossom Color*.—White lead and

vermilion. *Brown*.—Venetian red and lampblack. *Dark Green*.

—Lampblack and chrome green. *Olive Color*.—Red, green, or

black, yellow and red. *Snuff Color*.—Yellow, sienna, and red.

PRUSSIAN BLUE.—1st. Take nitric acid, any quantity, and as much

iron shavings from the lathe as the acid will dissolve; heat the

iron as hot as can be handled with the hand; then add it to the

acid in small quantities as long as the acid will dissolve it; then slowly add double the quantity of soft water that there was of acid, and put in iron again as long as the acid will dissolve it. 2d. Take prussiate of potash, dissolve it in the hot water to make a strong solution, and make sufficient of it with the first to give the depth of tint desired, and the blue is made.

ANOTHER METHOD.—A very passable Prussian blue is made by taking sulphate of iron (copperas) and prussiate of potash, equal parts of each; and dissolving each separately in water, then mixing the two waters.

CHROME YELLOW.—1st. Take sugar of lead and Paris white, of each 5 lbs.; dissolve them in hot water. 2d. Take bichromate of potash, $6\frac{1}{2}$ oz.; and dissolve it in hot water also; each article to be dissolved separately; then mix all together, putting in the bichromate last. Let stand twenty-four hours.

CHROME GREEN.—Take Paris white, $6\frac{1}{2}$ lbs.; sugar of lead, and blue vitriol, of each $3\frac{1}{2}$ lbs.; alum, $10\frac{1}{2}$ oz.; best soft Prussian blue and chrome yellow, of each $3\frac{1}{2}$ lbs. Mix thoroughly while in fine powder, and add water, 1 gal., stirring well, and let stand three or four hours.

GREEN, DURABLE AND CHEAP.—Take spruce yellow, and color it with a solution of chrome yellow and Prussian blue, until you give it the shade you wish.

ANOTHER METHOD.—Blue vitriol, 5 lbs.; sugar of lead, $6\frac{1}{2}$ lbs.; arsenic, $2\frac{1}{2}$ lbs.; bichromate of potash, $1\frac{1}{2}$ oz.; mix them thoroughly in fine powder, and add water 3 parts, mixing well again, and let stand three or four hours.

PEA BROWN.—1st. Take sulphate of copper any quantity, and dissolve it in hot water. 2d. Take prussiate of potash, dissolve it in hot water to make a strong solution; mix of the two solutions as in the blue, and the color is made.

ROSE PINK.—Brazil wood, 1 lb., and boil it for two hours, having 1 gal. of water at the end; then strain it, and boil alum, 1 lb., in the same water until dissolved; when sufficiently cool to admit the hand, add muriate of tin, $\frac{3}{4}$ oz. Now have Paris white, 12 lb.; moisten up to a salvy consistence, and when the first is cool stir them thoroughly together. Let stand twenty-four hours.

PATENT YELLOW.—Common salt, 100 lbs., and litharge, 400 lbs. are ground together with water, and for some time in a gentle heat, water being added to supply the loss by evaporation; the carbonate of soda is then washed out with more water, and the white residuum heated till it acquires a fine yellow color.

NAPLES YELLOW.—No. 1. Metallic antimony, 12 lbs.; red lead, 1 lbs.; oxide of zinc, 4 lbs. Mix, calcine, triturate well together, and fuse in a crucible: the fused mass must be ground and elevated to a fine powder.

CHEAP YELLOW PAINT.—Whiting, 3 cwt.; ochre, 2 cwt.; ground white lead, 25 lbs. Factitious linseed oil to grind.

STONE-COLOR PAINT.—Road-dust, 2 cwt.; ground white lead, 1 cwt.; whiting, 1 cwt.; ground umber, 14 lbs.; lime water, 6 gal. Factitious linseed oil to grind.

GLAZIER'S PUTTY.—Whiting, 70 lbs.; boiled oil, 30 lbs. Mix if too thin, add more whiting; if too thick, add more oil.

COMPOUND

blue, very fine required. oil and turpentine, with vermilion, Prussian blue, tute carmine, little Prussian blue, linseed oil, Venetian, to give a drab of Venetian Vermilion.—Red.—Mix, lead. Unfoment) and for floors.—yellow, and burnt white. This color is used very much, adding to it quality. Lead white lead, white lead, French yellow, vitriol. Green and chrome, ture of Prussian white lead, same. Another shade may be obtained by Another, oil, as to obtain and yellow stone color.—dampblack, and turpentine, and French with a little handsome drailings, &c. LEAD CO. in a ladle; grind it in a Good and burnt s A BEAUTIFUL and dries in spirits of t

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COMPOUND COLORS.—*Blue.*—Grind Prussian blue in turps, other blue, very fine in linseed oil; mix with white paint to the color required. *Straw.*—A mixture of chrome yellow and white lead, oil and turps. *Steel.*—Mix ceruse, Prussian blue, fine lac, and vermillion, with oil and turps. *Purple.*—White lead, Prussian blue and vermillion, with oil and turps. *French Grey.*—White lead and Prussian blue, tinged with vermillion, and for the last coat substitute carmine or lake for vermillion. *Drab.*—White lead with a little Prussian blue and French yellow, linseed oil and turps. *Another Drab.*—White lead with a little Prussian blue and lampblack, linseed oil and turps. *Dark Red, for common purposes.*—Mix English Venetian red, in boiled oil, with a little red lead and litharge, to give a drying quality. *Lighter Red.*—Mix together equal parts of Venetian red and red lead, in boiled oil and turps. *Imitation of Vermilion.*—Grind together, in oil, red lead and rose pink. *Deep Red.*—Mix, in oil, vermillion with a dust of Venetian red, or red lead. *Unfading Orange.*—This is a mixture of orange lead (orpiment) and French or stone yellow, oil and turps. *Bright Yellow, for floors.*—White lead and linseed oil, mixed with some French yellow, and a little chrome yellow to heighten it, some red lead, burnt white vitriol and litharge, added, to give it a drying quality. This color mixed with equal parts of boiled oil and turpentine, and used very thin. *Dark Yellow.*—Mix French yellow in boiled oil, adding to it a little red lead or litharge to give the paint a drying quality. *Light Yellow.*—This is a mixture of French yellow and white lead, with oil and turpentine. *Another.*—French yellow, white lead and red lead. *Another.*—This is a mixture of Prussian blue, French yellow, a small portion of Turkey umber, and a little burnt vitriol. Grind the same way. *Another, in oil.*—Mix Prussian blue and chrome yellow. Grind the same. *Another Shade.*—A mixture of Prussian blue and French yellow, with a small quantity of white lead and Turkey umber; add burnt white vitriol, ground the same. *Another, light.*—White mixed with verdigris. A variety of shades may be obtained by using blue and yellow with white lead. *Another, olive.*—Black and blue mixed with yellow, in such quantities as to obtain the colors or shades required. For distemper, use indigo and yellow pink mixed with whiting or white lead powder. *Free-stone color.*—A mixture of red lead, Venetian red, French yellow and lampblack, (varying the shade according to taste,) with linseed oil and turpentine. *Olive Green.*—Grind, separately, Prussian blue and French yellow, in boiled oil, then mix to the tints required with a little burnt white vitriol to act as a dryer. A cheap and handsome color for outside work, such as doors, carts, waggons, railings, &c.

LEAD COLOR FOR IRON.—Take litharge and place it over a fire in a ladle; sprinkle over it flour of brimstone, to turn it dark; grind it in oil. It dries quick, and stands well in any weather.

A GOOD IMITATION OF GOLD.—Mix white lead, chrome yellow and burnt sienna until the proper shade is obtained.

A BEAUTIFUL WHITE PAINT.—For inside work, which ceases to smell, and dries in a few hours. Add 1 lb. of frankincense to 2 quarts of spirits of turpentine; dissolve it over a clear fire, strain it, and

bottle it for use; then add 1 pint of this mixture to 4 pints of bleached linseed oil, shake them well together, grind white lead in spirits of turpentine, and strain it; then add sufficient of the lead to make it proper for painting; if too thick in using, thin with turpentine, being suitable for the best internal work on account of its superiority and expense.

FOR A PURE WHITE PAINT.—Nut-oil is the best; if linseed oil is used, add one-third of turpentine.

TO MIX COMMON WHITE PAINT.—Mix or grind white lead in linseed oil to the consistency of paste; add turpentine in the proportion of one quart to the gallon of oil; but these proportions must be varied according to circumstances. Remember to strain your color for the better sorts of work. If the work is exposed to the sun, use more turpentine for the ground-color, to prevent its blistering.

INVISIBLE GREEN FOR OUTSIDE WORK.—Mix lampblack and French yellow with burnt white vitriol. These colors mix in boiled oil. Burnt vitriol is the best drier for greens, as it is powerful and colorless, and, consequently, will not injure the color.

BRIGHT VARNISH GREEN, FOR INSIDE BLINDS, FENDERS, &C.—The work must first be painted over with a light lead color, and, when dry, grind some white lead in spirits of turpentine; afterwards take about $\frac{1}{2}$ in bulk of verdigris, which has been ground stiff in linseed oil; then mix them both together, and put into a little resin varnish, sufficient only to bind the color. When this is hard, which will be the case in 15 minutes, pour into the color some resin to give it a good gloss. Then go over the work a second time and, if required, a third time. Thus you will have a cheap and beautiful green, with a high polish. It possesses very drying quality, as the work may be completed in a few hours. The tint may be varied according to taste, by substituting mineral green for verdigris; and if a bright grass-green is required, add a little Dutch pink to the mixture.

N.B.—This color must be used when quite warm, to give the varnish an uniform extension.

COMPOUND GREENS.—This is a mixture of whiting, indigo and Dutch pink, the intensity of which may be increased or diminished by the addition of blue or yellow. These mixtures will not admit of any fixed rules in regard to the quantities of the matters used in their composition. They must depend on the taste of the artist and the tone he is desirous of giving to the color.

PEA GREEN.—Take one pound of genuine mineral green, one pound of the precipitate of copper, one pound and a half of blue verditer, three pounds of white lead, three ounces of sugar of lead, and three ounces of burnt white vitriol. Mix the whole of these ingredients in linseed oil, and grind them quite fine. It will produce a bright mineral pea-green paint, preserve a blue tint and keep any length of time in any climate, without injury, by putting water over it. To use this color for house or ship painting, take one pound of the green paint with some pale boiled oil, mix them well together, and this will produce a strong pea-green paint. The tint may be altered at pleasure, by adding a proportionate quantity of white lead to the green, which may be ground in linseed oil,

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and thinned with spirits of turpentine for use. It may also be used for painting Venetian window blinds, by adding white lead and mixing the color with boiled oil. For all the aforesaid preparations it will retain a blue tint, which is very desirable.

For KNOTTING.—One pint of vegetable naphtha, 1 teaspoonful of red lead, $\frac{1}{2}$ pint of japanners gold size, 7 ozs. of orange shellac, mix all together, set in a warm place to dissolve, and frequently shake.

ANOTHER.—Mix white lead, or red lead powder, in strong glue size, and apply it warm.

BEAUTIFUL COLOR FOR CARRIAGES, COACHES, &C.—Mix Victoria lake with black japan.

WHITE LEAD.—The most usual method of manufacturing white lead is that known as the Dutch method. It consists in exposing lead, cast in thin gratings, to the combined action of acetic acid moist air and carbonic acid gas. The gratings are supported a little above the bottom of earthen pots, similar to flower pots, in each of which a small quantity of weak acetic acid is placed. The pots are built up in alternate layers with spent tanners' bark, until a stack is formed, each layer of pots being covered with a board. Fermentation soon takes place in the tan, and serves the double purpose of generating heat and supplying carbonic acid. After the lapse of six or eight weeks, the metallic lead is found converted into white masses of carbonate mixed with hydrated oxide. It is then levigated, washed, dried, and ground with oil.

To CURE DAMP WALLS.—Boil 2 ozs. of grease with 2 quarts of tar, for nearly twenty minutes, in an iron vessel, and having ready pounded glass, 1 lb.; slacked lime, 2 lbs.; well dried in an iron pot and sifted through a flour sieve; add some of the lime to the tar and glass, to make it the thickness of thin paste, sufficient to cover a square foot at a time, as it hardens so quick. Apply it about an eighth of an inch thick.

To PROTECT WOOD AND BRICK WORK FROM DAMP WEATHER.—Take 3 pecks of lime, slacked in the air, 2 pecks of wood ashes, and 1 peck of white sand. Sift them fine, and add linseed oil sufficient to use with a paint brush; thin the first coat, use it as thick as it will work for the second coat, grind it fine, or beat it in a trough, and it is a good composition.

PUTTY FOR REPAIRING BROKEN WALLS.—The best putty for walls is composed of equal parts of whiting and plaster of Paris, as it quickly hardens. The walls may be immediately colored upon it. Some painters use whiting mixed with size; but this is not good, as it rises above the surface of the walls, and shows in patches when the work is finished. Lime must not be used as a putty to repair walls, as it will destroy almost every color it comes in contact with.

INSTRUCTIONS FOR SIGN WRITING, WITH THE COLORS TO BE USED FOR THE GROUND AND LETTERS.—On an oak ground, ornamental letters, in ultramarine blue, filled in with gold and silver leaf, blocked up and shaded with burnt sienna. *Another*.—Gold letters on a white marble ground, blocked up and shaded with a transparent brown or burnt sienna. *On glass*.—Gold letters, shaded with

burnt sienna. *Another.*—Gold letters, shaded with black, on a scarlet or chocolate ground. On a rich blue ground, gold letters, double shaded, black and white. White letters on a blue ground, shaded with black, look very well. On a purple ground, pink letters shaded with white. Mix ultramarine and vermilion for a ground color, white letters shaded with a light grey. Vermilion ground, chrome yellow, stained with vermilion and lake, for the letters, shaded black. A substitute for the above colors: Rose pink and red lead; and for the letters, stone yellow, white lead and Venetian red. A good substitute for gold is obtained by grinding white lead, chrome yellow, and a dust of vermilion together. Mix your colors for writing in boiled oil, and use for drier gold size. Other good grounds for gold letters are: blues, vermilion, lake, and Saxon. When your sign is ready for gilding, follow the directions given under the head of "To Gild Letters on Wood."

TO GIVE LUSTRE TO A LIGHT BLUE GROUND.—After the letters are written and dry, paint the ground over again, between the letters, with the same color, and while wet take pulverized Prussian blue and sift over the surface; glass, frost, or smalts may be used instead of or with the blue. When dry, brush off the loose particles.

TO REMOVE OLD PAINT.—Sal soda, 2 lbs.; lime, $\frac{1}{4}$ lb.; hot water, 1 gal.; rummage all together and apply to the old paint while warm. It will soon loosen the paint so that you can easily remove it. Another simple method is to sponge over your old paint with benzine, set it on fire, and you can then flake off the paint as quick as you like. Do not attempt to go over too much surface at a time, otherwise you might get more to do than you can attend to.

REFUSE PAINT AND PAINT SKINE.—Dissolve sal soda, $\frac{1}{2}$ lb., in rain water, 1 gal.; cover the refuse paint for 2 days, then heat it, adding oil to reduce it to a proper consistence for painting and straining.

SOLUBLE GLASS can be made on a small scale by fusing together in a crucible, 15 parts of sand with 8 parts carbonate of soda and 1 part charcoal, not soluble in cold water, but dissolves in boiling water, yielding a strongly alkaline liquor.

BLACK WALNUT STAIN.—Spirits of turpentine, 1 gal.; pulverized asphaltum, 2 lbs.; dissolve in an iron kettle on a stove, stirring constantly. Can be used over a red stain to imitate rosewood. To make a perfect black add a little lampblack. The addition of a little varnish with the turpentine improves it.

CRYSTAL VARNISH, FOR MAPS, &c.—Canada balsam, 1 oz.; spirits of turpentine, 2 ozs.; mix together. Before applying this varnish to a drawing or colored print, the paper should be placed on a stretcher, and sized with a thin solution of isinglass in water, and dried. Apply with a soft camels-hair brush.

TO EBONIZE WOOD.—Mix up a strong stain of copperas and log-wood, to which add powdered nut-gall. Stain your wood with this solution, dry, rub down well, oil, then use French polish made tolerably dark with indigo or finely powdered stone blue.

TO PAINT IN IMITATION OF GROUND GLASS.—Grind and mix white

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lead in three-fourths of boiled oil and one-fourth spirits of turpentine, and to give the mixture a very drying quality, add sufficient quantities of burnt white vitriol and sugar of lead. The color must be exceedingly thin, and put on the panes of glass with a large sized paint brush in as even a manner as possible. When a number of the panes are thus painted, take a dry duster quite new, dab the ends of the bristles on the glass in quick succession, till you give it an uniform appearance. Repeat this operation till the work appears very soft, and it will then appear like ground glass. When the glass requires fresh painting, get the old coat off first by using strong pearl-ash water.

ANOTHER METHOD.—Spirits of salts, 2 ozs.; oil of vitriol, 2 ozs.; sulphate of copper, 1 oz.; gum arabic, 1 oz.; mix all well together, and dab on the glass with a brush.

ANOTHER.—Dab your squares regularly over with putty; when dry, go over them again; the imitation will be complete.

PAINTING ON GLASS.—Take clear rosin, 1 oz., melt in an iron vessel. When all is melted, let it cool a little, but not harden; then add oil of turpentine sufficient to keep it in a liquid state. When cold, use it with colors ground in oil.

HARD DRYING PAINT.—Grind Venetian red, or any other color you wish, in boiled oil; then thin it with black japan. It will dry very hard for counter tops, &c.

SPIRIT GRAINING FOR OAK.—Two pounds of whiting, quarter of a pound of gold size, thinned down with spirits of turpentine; then tinge your whiting with Vandyke brown and raw sienna, ground fine. Strike out your lights with a fitch dipped in turpentine, tinged with a little color to show the lights. If your lights do not appear clear, add a little more turpentine. Turpentine varnish is a good substitute for the above mentioned. This kind of graining must be brushed over with beer, with a clean brush, before varnishing. Strong beer must be used for glazing up top-graining and shading.

OIL FOR GRAINING OAK.—Grind Vandyke brown in turpentine, add as much gold size as will set it, and as much soft soap as will make it stand the comb. Should it set too quickly, add a little boiled oil. Put a teaspoonful of gold size to half a pint of turpentine, and as much soap as will lie on a twenty-five cent piece, then take a little soda mixed with water and take out the veins.

TO PREPARE THE GROUND FOR OAK ROLLERS.—Stain your white lead with raw sienna and red lead, or with chrome yellow and Venetian red; thin it with oil and turps, and strain for use. When the ground work is dry, grind in beer Vandyke brown, whiting and a little burnt sienna, for the graining color; or you may use raw sienna with a little whiting, umbers, &c.

TO IMITATE OLD OAK.—To make an exceedingly rich color for the imitation of old oak, the ground is a composition of stone ochre or orange chrome and burnt sienna; the graining color is burnt umber or Vandyke brown, to darken it a little. Observe that the above colors must be used whether the imitation is in oil or distemper. When dry, varnish.

TO IMITATE OLD OAK, IN OIL.—Grind Vandyke and whiting in

turpentine, add a bit of common soap to make it stand the comb, and thin it with boiled oil.

TO IMITATE POLLARD OAK.—The ground color is prepared with a mixture of chrome yellow, vermilion, and white lead, to a rich light buff. The graining colors are Vandyke brown and small portions of raw and burnt sienna and lake ground in ale or beer. Fill a large tool with color, spread over the surface to be grained, and soften with the badger hair brush. Take a moistened sponge between the thumb and finger, and dapple round and round in kind of knobs, then soften very lightly; then draw a softener from one set of knobs to the other while wet, to form a multiplicity of grains, and finish the knots with a hair pencil, in some places in thicker clusters than others. When dry put the top grain on in a variety of directions, and varnish with turps and gold size; then glaze up with Vandyke and strong ale. To finish, varnish with copal.

TO IMITATE MOTTLED MAHOGANY.—The ground is prepared with the best English Venetian red, red lead, and a small portion of white lead. The graining colors are burnt sienna, ground in ale, with a small portion of Vandyke brown, sufficient to take away the fiery appearance of the sienna. Cover the surface to be grained, soften with the badger hair brush, and while wet take a mottling-roller and go over the lights a second time, in order to give a variety of shade, then blend the whole of the work with the badger softener. Put the top grain on with the same color. When dry, varnish.

TO IMITATE ROSEWOOD.—Mix vermilion and a small quantity of white lead for the ground. Take rose pink, tinged with a little lampblack, or Vandyke brown, and grind very fine in oil, then take a flat graining brush, with the hairs cut away at unequal distances, and cut down the grain as if wending round a knot. When nearly dry, take a graining comb that is used for oak, and draw down the grain. This will give it the appearance of nature. When dry, varnish.

ANOTHER.—This ground color is prepared with vermilion and small quantities of white lead and crimson lake. When the ground is dry and made very smooth, take Vandyke brown, ground in oil, and with a small tool spread the color over the surface in different directions forming kind of knots. Before the work is dry, take a piece of leather, and with great freedom strike out the light veins; having previously prepared the darkest tint of Vandyke brown, or gum asphaltum, immediately take the flat graining brush with few hairs in it, draw the grain over the work and soften, When varnished the imitation will be excellent.

ANOTHER ROSEWOOD IMITATION IN SIZE.—Mix Venetian red, white lead powder, vermilion and common size, the consistency of which, when cold, must be that of a weak trembling jelly. With this composition paint the work twice over. When the ground is dry, take some lamp black, finely ground in beer, and beat the white of an egg into it, take the flat graining brush, dipped in the black, and put on the grain. When dry, stain the first coat of

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varnish with rose pink, finely ground in turpentine, and finish the work by giving it a coat of clear varnish.

To IMITATE BIRD'S EYE MAPLE.—The ground is a light buff, prepared with white lead, chrome yellow, and a little vermilion or English Venetian red, to take off the rawness of the yellow. The graining color is equal parts of raw umber and sienna ground in oil to the proper consistency. Spread the surface of the work with this color, and, having some of the same prepared a little thicker, immediately take a sash tool or sponge, and put on the dark shades, and soften with the badgers hair brush; before the color is dry put on the eyes by dabbing the dotting machine on the work. When dry, put on the grain with the camels-hair pencil on the prominent parts, to imitate the small hearts of the wood. When dry, varnish.

To IMITATE CURLED MAPLE.—Prepare a light yellow for the ground, by mixing chrome yellow and white lead, tinged with Venetian red. The graining color is a mixture of equal portions of raw sienna and Vandyke, ground in ale, spread the surface to be grained in an even manner; then with a piece of cork rub across the work to and fro, to form the grains which run across the wood; soften and, when dry, lightly top-grain with the same color. When dry, varnish.

CURLED MAPLE IN OIL FOR OUTSIDE WORK.—Prepare a rich ground by mixing chrome yellow, white lead and burnt sienna. For the graining color, grind equal parts of raw sienna and umber, with a little burnt copperas in turpentine, and mix with it a small quantity of grainers cream. Thin the color with boiled oil; then fill a tool and spread the surface even, and rub out the lights with the sharp edge of a piece of buff leather, which must now and then be wiped to keep it clean; soften the edges of the work very lightly, and when dry, put on the top grain with burnt umber and raw sienna, ground in ale, with the white of an egg beat into it. When dry varnish.

SATINWOOD.—This ground is prepared with white lead, stone-ochre, and small quantities of chrome yellow and burnt sienna. The graining color is one-third of raw sienna and whiting, ground in pale ale, very thin; then spread the color over the surface to be grained. While wet, soften, and have ready a wet roller or mottling brush, in order to take out the lights; blend the whole with the badger hair brush. When the work is dry, take the flat brush, and with the same color, put on the top grain. When dry, varnish.

To IMITATE YEW TREE.—The ground is a reddish buff. For the graining color grind in ale equal portions of vandyke brown and burnt sienna, with a small quantity of raw sienna. When the ground is dry, spread the surface even with the color, and soften; then with a piece of cork with a sharp edge, rub the work cross and cross in order to form the fine grain, as in curled maple, and soften the same way of the grain. When dry, dip the tip of your fingers in the graining color to form the eyes or knots, and put in the small touches with a camels-hair pencil. When dry, put on the top grain, and when this is dry, varnish.

TO IMITATE BLACK AND GOLD MARBLE.—This description of marble is now in great demand. The ground is a deep jet black, or a dead color, in gold size, drop black and turps : second coat, black japan. Commence veining ; mix white and yellow ochre with a small quantity of vermilion to give a gold tinge ; dip the pencil in this color, and dab on the ground with great freedom some large patches, from which small threads must be drawn in various directions. In the deepest parts of the black, a white vein is sometimes seen running with a great number of small veins attached to it ; but care must be taken that these threads are connected with, and run in some degree in the same direction with the thicker veins. If durability is not an object, and the work is required in a short time, it may be executed very quick in distemper colors, and when varnished, it will look well.

RED MARBLE.—For the ground, put on a white tinged with lake or vermilion ; then apply deep rich reds in patches, filling up the intermediate spaces with brown and white mixed in oil ; then blend them together ; if in quick drying colors, use about half turps and gold size. When dry, varnish ; and while the varnish is wet, put in a multitude of fine white threads, crossing the whole work in all directions, as the wet varnish brings the pencil to a fine point.

JASPER MARBLE.—Put on a white ground lightly tinged with blue ; then put on patches of rich reds or rose pink, leaving spaces of the white grounds ; then partly cover those spaces with various browns to form fossils, in places running veins ; then put in a few spots of white in the centre of some of the red patches, and leaving in places masses nearly all white. When dry, use the clearest varnish.

BLUE AND GOLD MARBLE.—For the ground put on a light blue ; then lake blue, with a small piece of white lead and some dark common blue, and dab on the ground on patches, leaving portions of the ground to shine between ; then blend the edges together with a duster or softener ; afterwards draw on some white veins in every direction, leaving large open spaces to be filled up with a pale yellow or gold-paint ; finish with some fine white running threads, and a coat of varnish at last.

TO IMITATE GRANITE.—For the ground color, stain your white lead to a light lead color, with lamp black and a little rose pink. Throw on black spots, with a graining machine, a pale red, and fill up with white before the ground is dry.

ANOTHER.—A black ground, when half dry, throw in vermilion, a deep yellow and white spots.

TO IMITATE HAIR WOOD.—For the ground-color, take white lead and thin it with turpentine, and slightly stain it with equal quantities of Prussian blue and lamp black. For the graining color, grind in ale a mixture of Prussian blue and raw sienna ; when the ground is dry, spread a transparent coat of the graining color on the surface of the work, and soften ; then with the cork, mottle by rubbing it to and fro across the work to form the fine long grain or mottle. When this is done, soften and top grain in a wavy but perpendicular directions ; varnish when dry.

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SUBSTITUTE FOR WHITE LEAD.—Sulphate of barytes ground in oil and applied like paint. It can also be used to reduce white lead to any desired extent.

PAINT FOR BLACK BOARDS IN SCHOOLS.—Common glue, 4 oz.; flour of emery, 3 oz.; and just lampblack enough to give an inky color to the preparation. Dissolve the glue in $\frac{3}{4}$ qt. of warm water, put in the lampblack and emery, stir till there are no lumps, then apply to the board with a woollen rag smoothly rolled. Three coats are amply sufficient.

COMPOUND IRON PAINT.—Finely pulverized iron filings, 1 part; brick dust, 1 part; and ashes, 1 part. Pour over them glue-water or size, set the whole near the fire, and, when warm, stir them well together. With this paint cover all the wood work which may be in danger; when dry, give a second coat, and the wood will be rendered incombustible.

BEST WASH FOR BARNs AND HOUSES.—Water lime, 1 peck; freshly slaked lime, 1 peck; yellow ochre in powder, 4 lbs.; burnt umber, 4 lbs. To be dissolved in hot water, and applied with a brush.

DURABLE OUTSIDE PAINT.—Take 2 parts (in bulk) of water lime, ground fine; 1 part (in bulk) of white lead, in oil. Mix them thoroughly, by adding *best* boiled linseed oil, enough to prepare it to pass through a paint-mill; after which, temper with oil till it can be applied with a common paint-brush. Make any color to suit. It will last 3 times as long as lead paint. It is SUPERIOR.

FARMERS' PAINT.—Farmers will find the following profitable for house or fence paint: skim milk, two quarts; fresh slacked lime 8 oz.; linseed oil, 6 oz.; white Burgundy pitch, 2 oz.; Spanish white, 3 lbs. The lime is to be slacked in water, exposed to the air, and then mixed with about one-fourth of the milk; the oil in which the pitch is dissolved to be added, a little at a time, then the rest of the milk, and afterwards the Spanish white. This is sufficient for twenty-seven yards, 2 coats. This is for white paint. If desirable, any other color may be produced; thus, if a cream color is desired, in place of part of the Spanish white use the ochre alone.

PAINTING IN MILK.—Skimmed milk, $\frac{1}{2}$ gallon, newly slacked lime, 6 oz.; and 4 oz. of poppy, linseed, or nut oil; and 3 lbs. Spanish white. Put the lime into an earthen vessel or clean bucket; and having poured on it a sufficient quantity of milk to make it about the thickness of cream, add the oil in small quantities, a little at a time, stirring the mixture well. Then put in the rest of the milk, afterwards the Spanish white finely powdered, or any other desired color. For out-door work add 2 oz. each more of oil and slacked lime, and 2 oz. of Burgundy pitch dissolved in the oil by a gentle heat.

PREMIUM PAINT WITHOUT OIL OR LEAD.—Slack stone-lime with boiling water in a tub or barrel to keep in the steam; then pass 6 quarts through a fine sieve. Now to this quantity add 1 quart of coarse salt, and 1 gallon of water; boil the mixture, and skim it clear. To every 5 gallons of this skimmed mixture, add 1 lb. alum; $\frac{1}{2}$ lb. copperas; and by slow degrees $\frac{3}{4}$ lb. potash, and 4 quarts sifted ashes or fine sand; add any coloring desired. A more durable paint was never made.

GREEN PAINT FOR GARDEN STANDS, BLINDS, ETC.—Take mineral green, and white lead ground in turpentine; mix up the quantity you wish with a small quantity of turpentine varnish. This serves for the first coat. For the second, put as much varnish in your mixture as will produce a good gloss. If you desire a brighter green, add a little Prussian blue, which will much improve the color.

MILK PAINT, FOR BARNS, ANY COLOR.—Mix water lime with skim milk, to a proper consistence to apply with a brush, and it is ready to use. It will adhere well to wood, whether smooth or rough, to brick, mortar, or stone, where oil has not been used (in which case it cleaves to some extent), and forms a very hard substance, as durable as the best oil paint. It is too cheap to estimate, and any one can put it on who can use a brush. Any color may be given to it, by using colors of the tinge desired. If a red is preferred, mix Venetian-red with milk, not using any lime. It looks well for fifteen years.

PAINT.—TO MAKE WITHOUT LEAD OR OIL.—Whiting, 5 lbs.; skimmed milk, 2 qts.; fresh slacked lime, 2 oz. Put the lime into a stoneware vessel, pour upon it a sufficient quantity of the milk to make a mixture resembling cream; the balance of the milk is then to be added; and lastly, the whiting is to be crumbled upon the surface of the fluid, in which it gradually sinks. At this period it must be well stirred in or ground, as you would other paint, and it is fit for use.

TRANSPARENT PAINTING ON WINDOW SHADES.—The muslin is spread on a frame and secured tightly with tacks, then sized with a mixture of fine flour paste, white glue, and white bar soap; the soap renders the muslin pliable and soft. A thin coat is applied, which is nearly invisible when dry. A coat of pure linseed oil, diluted with spirits of turpentine, is then applied to the whole, or a part, as desired; lay it on quickly and smoothly, to ensure an even transparent surface. The colors used are, ivory black, ultramarine, Paris green, sienna, umber, verdigris, asphaltum, or other suitable colors. An outline of the design is drawn with a small pencil with black or umber, after which the colors may be applied, more or less diluted, as more or less transparency is desired. In general, the brightest colors should be applied first, and the darker shades over them. These colors must be laid evenly and smoothly with soft brushes, and should any part be made too dark, the best way is to scrape off with a stick before the color gets too dry. The best designs for shades consist of landscape views, and should always be designed to accommodate the form and position of the ground on which they are drawn. Stencils will be found useful on this work, in marking corners or stripes for borders.

TO USE SMALTS.—For a gold lettered sign, lay out on a lead color or white surface the line of letters, and roughly size the shape of each letter with *fat oil size*. This must be allowed at least 12 hours to get tacky and ready for gilding. After the gold leaf is laid and perfectly dry, mix up (for blue smalts) Prussian blue and keg lead with oil, adding a little dryer. Outline carefully around the letters, and fill up all the outside with blue paint; then with a small sieve sift on the smalts, allowing the sign to lay horizontally. Cover every part with plenty of smalts, and allow it to

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remain unmolested until the paint is dry. Then carefully shake off the surplus smalts, and the work is done.

TO PAINT MAGIC LANTERN SLIDES.—Transparent colors only are used for this work, such as lakes, sap-green, ultramarine, verdigris, gamboge, asphaltum, &c., mixed in oil, and tempered with light colored varnish (white Demar). Draw on the paper the design desired, and stick it to the glass with water or gum; then with a fine pencil put the outlines on the opposite side of the glass with the proper colors; then shade or fill up with black or vandyke brown, as you find best.

SILVER POLISH KALSOMINE.—Take 7 lbs. of Paris white and $\frac{1}{2}$ lb. of light colored glue. Set the glue in a tin vessel containing 3 pts. of water; let it stand overnight to soak. Then put it in a kettle of boiling water over the fire, stirring till it is well dissolved and quite thin. Then, after putting the Paris white into a large water-pail, pour on hot water and stir it till it appears like thick milk. Now mingle the glue liquid with the whiting, stir it thoroughly and apply with a whitewash-brush, or a large paint brush.

MARINE PAINT FOR METALS IN SALT WATER.—Red lead, 50 parts; quicksilver, 30 parts; thick turpentine, 7 parts. Mix with boiled linseed oil to the proper consistency. The quicksilver must be thoroughly amalgamated with the thick turpentine by grinding or rubbing, and this mixture must be ground with the red lead and more boiled oil. As little oil as is necessary to make the paint lay well must be used. To make the paint adhere more firmly, a previous coat of oxide of iron paint may be used.

TO IMITATE TORTOISE SHELL.—Paint a ground of salmon color; then when dry and smoothed off, coat it over with rose pink, mixed in varnish and turpentine; then with a flat piece of glass, press on the surface, and remove the glass quickly, being careful not to push it over the paints so as to disturb the curious figures which the pressure will form thereon. Varnish when dry, and you will find you have a beautiful imitation of tortoise shell.

BANNER PAINTING.—Lay out the letters very accurately with charcoal or crayon, then saturate the cloth with water to render the painting easy. On large work a stencil will be found useful. Take a piece of tin, lay the straight edge to the mark, brush over with a sash tool, and by this means you will make a very clean-edged letter. Use stiff bristle pencils in painting on canvas.

OIL CLOTH PAINTING.—To paint canvas for floors, the canvas should first be saturated with glue-water or flour paste, and allowed to dry first. Then paint it with any color desired. To put in the figures, cut out designs in tin plates or stiff paper, and stencil them on in various colors.

TO IMITATE MARBLE.—For white marble, get up a pure white ground, then hold a lighted candle near the surface, and allow the smoke to form the shades and various tints desired. This will make a very handsome imitation. Black marble imitation is made by streaking a black surface with colors, using a feather and pencil. Another plan is to get up a smooth black surface; then take the colors, green, yellow, red, white, &c., ground thick in gold size, and streak the surface with a stick or pencil. Allow it to dry, and apply a heavy coat of lampblack and yellow ochre, mixed with

rough stuff. When all is hard, rub down to a level surface with lump pumice stone, varnish, and a beautiful variegated marble will be the result.

GILDING AND ORNAMENTS CARRIAGES.—English gold size is the best for this purpose. If you cannot get it ready prepared, make a substitute by using English varnish and japan in equal parts. If the gilding is for striping, you should mix a little chrome yellow with it, to be able to see the lines the better, but for lettering no coloring is required. Rub your job down smoothly, take a piece of muslin and tie up in it a little whitening to form a "pounce bag," with this dust over every part of the work where the gold leaf is to be put, to prevent the leaf sticking to the surface not covered by the size, or wash the job over with starch water, or rub it over with the raw surface of a potatoe cut in halves; the juice of the potatoe soon dries, and leaves a thin film to which the gold will not adhere. Either of the above methods will do, and the coating will wash off when the gilding is dry. The surface prepared, take the size and put on the stripes, figures, or ornaments, and allow it to dry just enough to enable you to pass your finger over it without sticking, but if it is "tacky" when you place your finger upon it, it is ready for the gold leaf, which is to be applied in the way directed for gilding letters on wood. The gold letters may be shaded with ultramarine, carmine, asphaltum, lake, Paris green verdigris, &c. to suit the taste.

BRONZING.—Gold bronze is used on carriage parts for striping and ornamenting, using the same size as that used for gold leaf. For taking up and applying the bronze, take a piece of plush or velvet and make a "pounce bag," by tying up a wad of cotton, rubbing the bronze gently over the size. To vary the appearance, a mixture of copper, gold, and silver bronze may be applied. For fancy work in bronze, cut out any desired pattern on thin sheet brass, pasteboard, or paper, and apply it to any nearly dry varnished surface; rub the bronze on through the apertures in the pattern.

GOOD COLORS FOR BUSINESS WAGGONS.—No. 1. *Body.*—Chrome green; frame or ribs, black, striped with white or cream color. *Running gear.*—Cream color, striped with red, blue or dark green, or black, and red fine line. No. 2. *Body.*—Yellow; frame black, striped with blue or white. *Running gear.*—Light vermilion, striped with black and white. No. 3. *Body.*—Carmine glaze over Indian red. *Running gear.*—Vermilion. No. 4. *Body.*—Deep vermilion. *Running gear.*—Light vermilion.

MIXTURE TO REMOVE OLD PAINT.—Dissolve 1 lb. potash in 3 pts. water over the fire, then add yellow ochre or some common dry paint until it is as thick as rough stuff; spread this over your old paint, and after a little it will come off quite easily, then wash the wood with soap and water to remove all the potash, dry off and sand-paper, then give a coat of clean raw oil. Another method is to heat a heavy piece of iron and apply to the paint, which will cause it to become loose and soft, so that it may be scraped off with a knife. Still another method is to direct the flame of a spirit lamp (which may be constructed for the purpose) on the old paint, scraping it off as it softens.

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TO BLEACH OIL.—Pour as much linseed oil into a shallow earthen vessel as will stand one inch deep, then pour in 6 inches of water, cover with a fine cloth, and let the whole stand in the sun for a few weeks until the liquid becomes thick, when it should be poured into a phial and submitted to a gentle heat; after which the clear is to be poured off and strained through a flannel cloth.

TO COPY AN ORNAMENT.—Place the paper or other article containing the ornament against a pane of glass; then laying a sheet of thin paper over it, you can copy it exactly with a lead pencil.

ORNAMENTS, in the shape of decalcomine or other gilded pictures, may be easily transferred to carriages or coaches by following the directions given in transferring pictures to glass.

VERMILION.—To prevent vermilion from fading, add to the dry color, before mixing, $\frac{1}{4}$ part of flour of sulphur. Light English vermilion is used for striping, ornamenting or lettering; the deep vermilion having less body, will not cover good. English vermilion gives the best color on carriage work when mixed with rubbing varnish and oil. American vermilion should not be ground, as the process would change it to an orange color; while green, Indian red, chrome-yellow, and all heavy body colors are all the better for being ground as fine as possible. Raw oil is preferable to boiled, as it is more volatile, and penetrates and fills the pores of the wood better.

PRIMING FOR CARRIAGE WORK.—*First coat of lead.* Mix white lead with raw oil, 2 parts, japan, 1 part, to make it proper for a thick coat, adding a very little turpentine to make it work easily. For carriage parts add a little Indian black, but not for bodies. *Second coat of lead.* Mix white lead with 1 part raw oil and 2 parts japan, and a little turpentine, as before, adding lampblack for carriage parts, but none for the body. *Third and fourth coat.* Mix white lead into a thick paste with turpentine, add a little oil, japan and rubbing varnish to bind the paint well; add, for the carriage parts, a little lampblack and a little red lead.

HARD DRYING PUTTY.—*For carriage work.*—Mix dry white lead with japan and rubbing varnish equal parts, to the proper consistency, beating it with a small mallet to bruise the lumps. Keep it, when not in use, in water, to prevent its drying.

ROUGH STUFF.—*For carriage work.*—Take 3 parts of English filling (ground state), 2 parts dry white lead, 1 part white lead in oil. Mix with japan, 2 parts, rubbing varnish, 1 part. Mix and crush thoroughly by running all through the mill together.

FACING LEAD FOR CARRIAGE WORK.—Mix dry white lead with 2 parts japan, 1 part rubbing varnish, and thin with spirits of turpentine, adding a little lampblack to make a clean lead color, and run all through the mill.

COACH PAINTING.—The panels of such work are generally painted in color, while the pillars, top strip, quarters, deck, &c., are always black; umber colors, lakes, greens, and blues are some of the best colors used on this work. To prepare the body for any of these colors, a ground color is used in the place of lampblack on black work. The following are a few approved grounds. *Lake.*—Indian red and vermilion mixed to a dark brown, but some prefer a black ground for lake. *Ultramarine.*—Mix a medium blue with white lead

and Prussian blue. *Vermilion*.—A light pink color is generally used as a ground for vermilion. *Green*.—Green and all heavy-bodied colors will cover well on the lead colors without any ground color.

FISH-OIL PAINTS.—Dissolve white vitriol and litharge, of each 14 lbs., in vinegar, 32 gals.; add whale, seal, or cod oil, 1 tun, and boil to dryness, continually stirring during the ebullition. The next day, decant the clear portion; add linseed oil, 12 gals.; oil of turpentine, 3 gals., and mix well together. The sediment left is well agitated with half its quantity of lime-water, used for some inferior paints under the name of "*prepared residue oil*." This oil is used for various common purposes, as a substitute for linseed oil, of which the following paints are examples:—*Pale Green*.—Lime-water, 6 gals.; whiting and road-dust, of each, 1 cwt.; blue-black, 30 lbs.; yellow ochre, 28 lbs.; wet blue (previously ground in *prepared residue oil*), 20 lbs.; grind well together. For use, thin with equal parts of *prepared residue oil* and linseed-oil. 2. *Bright Green*.—Yellow ochre and wet blue, of each, 1 cwt.; road-dust, 1½ cwt.; blue-black, 10 lbs.; lime water, 6 gals.; prepared fish-oil, 4 gals.; prepared residue and linseed oils, of each, 7½ gals. 3. *Lead Color*.—Whiting, 1 cwt.; blue black, 7 lbs.; white lead (ground in oil), 28 lbs.; road-dust, 56 lbs.; lime water, 5 gals.; prepared residue oil, 2½ gals. 4. *Reddish Brown*.—Lime-water, 8 gals.; Spanish-browa, 1 cwt.; road-dust, 2 cwt.; prepared fish, prepared residue and linseed oils, of each, 4 gals. 5. *Yellow*.—Substitute ochre for Spanish-brown in the last receipt. 6. *Black*.—Substitute lamp or blue black for Spanish-brown in No. 4. 7. *Stone Color*.—Lime-water, 4 gals.; whiting, 1 cwt.; white-lead (ground in oil), 28 lbs.; road-dust, 56 lbs.; prepared fish, linseed, and prepared residue oils, of each, 3 gals. 8. *Chocolate*.—No. 4 and 6 mixed together so as to form a chocolate-color. *Remarks*.—All the above paints require a little "drier." They are well fitted, by their cheapness, hardness, and durability, for common out-door work.

PORCELAIN FINISH, VERY HARD AND WHITE, FOR PARLORS.—To prepare the wood for the finish, if it be pine, give one or two coats of the "*Varnish—Transparent for Wood*," which prevents the pitch from oozing out, causing the finish to turn yellow; next, give the room at least four coats of pure zinc, which may be ground in only sufficient oil to enable it to grind properly; then mix to a proper consistence with turpentine or naphtha. Give each coat time to dry. When it is dry and hard, sand-paper it to a perfectly smooth surface, when it is ready to receive the finish, which consists of two coats of French zinc ground in, and thinned with Demar-varnish, until it works properly under the brush.

JAPAN DRIER, BEST QUALITY.—Take linseed oil, 1 gal.; put into it gum shellac, ½ lb.; litharge and burned Turkey umber, each ½ lb.; red lead, ½ lb.; sugar of lead, 6 oz. Boil in the oil till all are dissolved, which will require about four hours; remove from the fire, and stir in spirits of turpentine, 1 gal., and it is done.

ANOTHER.—Linseed oil, 5 gals.; add red lead and litharge, each 3½ lbs.; raw umber, 1½ lbs.; sugar of lead and sulphate of zinc, each, ½ lb.; pulverize all the articles together, and boil in the oil till dissolved; when a little cool, thin with turpentine, 5 gals.

DRYING OIL EQUAL TO PATENT DRIERS AT ONE QUARTER THEIR PRICE.—Linseed oil, 2 gals.; red lead and umber, each, 4 oz.; sulphate of zinc, 2 oz.; sugar of lead, 2 oz. Boil until it will scorch a feather, when it is ready for use.

PREPARED OIL FOR CARRIAGES, &C.—To 1 gal. linseed oil add 2 lbs. gum shellac; litharge, $\frac{1}{2}$ lb.; red lead, $\frac{1}{2}$ lb.; umber, 1 oz. Boil slowly as usual until the gums are dissolved; grind your paints in this (any color), and reduce with turpentine. Yellow ochre is used in floor painting.

DRYING OILS.—1. Nut or linseed oil, 1 gal.; litharge, 12 oz.; sugar of lead and white vitriol, of each 1 oz.; simmer and skim until a pellicle forms; cool, and, when settled, decant the clear. 2. Oil 1 gal.; litharge, 12 to 16 oz.; as last. 3. Old nut or linseed oil, 1 pint; litharge, 3 oz. Mix; agitate occasionally for 10 days; then decant the clear. 4. Nut oil and water, of each 2 lbs.; white vitriol, 2 oz.; boil to dryness. 5. Mix oil with powdered snow or ice, and keep it for 2 months without thawing.

TO REDUCE OIL PAINT WITH WATER.—Take 8 lbs. of pure unslacked lime, add 12 qts. water, stir it and let it settle, turn it off gently and bottle it, keep it corked till used. This will mix with oil, and in proportion of half will render paint more durable.

OIL PAINT.—TO REDUCE WITH WATER.—Gum shellac, 1 lb.; sal-soda, $\frac{1}{2}$ lb.; water, 3 parts; boil all together in a kettle, stirring till dissolved. If it does not all dissolve, add a little more sal-soda; when cool, bottle for use; mix up 2 quarts of oil paint as usual, any color desired, using no turpentine; put 1 pint of the gum shellac mixture with the oil paint when it becomes thick; it can then be reduced with water to a proper thickness to lay on with a brush.

ANOTHER METHOD.—Soft water, 1 gal.; dissolve in it pearlsh, 3 oz.; bring to a boil, and slowly add shellac, 1 lb.; when cold, it is ready to be added to oil paint in equal proportions.

HOW TO BUILD GRAVEL HOUSES.—This is the best building material in the world. It is four times cheaper than wood, six times cheaper than stone, and superior to either. Proportions for mixing: to eight barrows of slacked lime, well deluged with water, add 15 barrows of sand; mix these to a creamy consistency, then add 60 barrows of coarse gravel, which must be worked well and completely; you can then throw stones into this mixture, of any shape or size, up to ten inches in diameter. Form moulds for the walls of the house by fixing boards horizontally against upright standards, which must be immovably braced so that they will not yield to the immense pressure outwards as the material settles; set the standards in pairs around the building where the walls are to stand, from six to eight feet apart, and so wide that the inner space shall form the thickness of the wall. Into the moulds thus formed throw in the concrete material as fast as you choose, and the more promiscuously the better. In a short time the gravel will get as hard as the solid rock.

FLEXIBLE PAINT FOR CANVAS.—Yellow soap, 2 $\frac{1}{2}$ lbs.; boiling water, 1 $\frac{1}{2}$ gals.; dissolve; grind the solution while hot with good oil paint, 1 $\frac{1}{2}$ cwt.

PAINTER'S CREAM.—Pale nut oil, 6 oz.; mastic, 1 oz.; dissolve; add of sugar of lead $\frac{1}{2}$ oz., previously ground in the least possible

quantity of oil; then add of water *q. s.* gradually, until it acquires the consistency of cream, working it well all the time. Used to cover the unfinished work of painters. It will wash off with water.

PAINTS, DIFFERENT SORTS.—**BLUE.**—Blue-black, 25 lbs.; whiting, 100 lbs.; road dust, sifted, 200 lbs.; lime-water, 12 gallons. Factitious linseed oil to grind.

WHITE PAINT.—Whiting, 500 lbs.; white lead, 400 lbs.; lime-water, 20 gallons. Factitious linseed oil to grind.

BLACK PAINT.—Ivory or lampblack, 100 lbs.; road-dust, sifted, 200 lbs.; lime water, 18 gallons. Oil to grind.

BROWN PAINT.—Venetian red, or Spanish brown, 1 cwt.; red-dust, 3 cwt.; common soot, 28 lbs.; lime-water, 15 lbs. Factitious linseed oil to grind.

PARIS GREEN.—Take unslacked lime of the best quality, slack it with hot water; then take the finest part of the powder, and add alum-water as strong as it can be made, sufficient to form a thick paste; then color it with bichromate of potash and sulphate of copper until the color suits your fancy, and dry it for use. N.B. —The sulphate of copper gives a blue tinge; the bichromate of potash, a yellow. Observe this, and you will get it right.

BEAUTIFUL GREEN PAINT FOR WALLS.—Take 4 lbs. Roman vitriol, and pour on it a tea-kettle full of boiling water. When dissolved, add 2 lbs. pearlash, and stir the mixture well with a stick until the effervescence ceases; then add $\frac{1}{2}$ lb. pulverized yellow arsenic, and stir the whole together. Lay it on with a paint brush; and if the wall has not been painted before, 2 or even 3 coats will be requisite. If a pea-green is required, put in less, if an apple-green, more, of the yellow arsenic. This paint does not cost the quarter of oil-paint, and looks better.

BLUE COLOR FOR CEILINGS, &C.—Boil slowly for 3 hours 1 lb. blue vitriol and $\frac{1}{2}$ lb. of the best whiting in about 3 qts. water; stir it frequently while boiling, and also on taking it off the fire. When it has stood till quite cold, pour off the blue liquid, then mix the cake of color with good size, and use it with a plasterer's brush in the same manner as whitewash, either for walls or ceilings.

TO HARDEN WHITEWASH.—To $\frac{1}{2}$ pail of common whitewash add $\frac{1}{2}$ pint of flour. Pour on boiling water in a sufficient quantity to thicken it. Then add 6 gals. of the lime and water, and stir well.

WHITEWASH THAT WILL NOT RUB OFF.—Mix up half a pailful of lime and water, ready to put on the wall; then take $\frac{1}{4}$ pt. of flour, mix it up with water; then pour on it boiling water, a sufficient quantity to thicken it; then pour it while hot into the whitewash, stir all well together, and it is ready for use.

WHITEWASH.—The best method of making a whitewash for outside exposure is to slack a $\frac{1}{2}$ bushel of lime in a barrel, add 1 lb. of common salt, $\frac{1}{2}$ lb. of the sulphate of zinc, and a gallon of sweet milk.

SUBSTITUTE FOR PLASTER OF PARIS.—Best whitening, 2 lbs.; glue, 1 lb.; linseed oil, 1 lb. Heat all together, and stir thoroughly. Let the compound cool, and then lay it on a stone covered with powdered whitening, and heat it well till it becomes of a tough and firm consistence; then put it by for use, covering with wet cloths to

keep it fresh. When wanted for use, it must be cut in pieces adapted to the size of the mould, into which it is forced by a screw press. The ornament may be fixed to the wall, picture frame, &c., with glue or white lead. It becomes in time as hard as stone itself.

ROMAN CEMENT.—Drift sand, 94 parts; unslacked lime, 12 lbs.; and 4 lbs. of the poorest cheese grated; mix well; add hot (not boiling) water to reduce to a proper consistence for plastering. Work well and quick with a thin smooth coat.

SMALT.—Roast cobalt ore to drive off the arsenic; make the residuum into a paste with oil of vitriol, and heat it to redness for an hour; powder, dissolve in water, and precipitate the oxide of iron by carbonate of potash, gradually added until a rose-colored powder begins to fall; then decant the clear, and precipitate by a solution of silicate of potash, prepared by fusing together for 5 hours a mixture of 10 parts of potash, 15 parts of finely-ground flints, and 1 part charcoal. The precipitate, when dry, may be fused and powdered very fine.

FACTITIOUS LINSEED OIL.—Fish or vegetable oil, 100 gallons; acetate of lead, 7 lbs.; litharge, 7 lbs.; dissolved in vinegar, 2 gals. Well mixed with heat, then add boiled oil, 7 gallons; turpentine, 1 gallon. Again well mix.

VARNISHES.—**COMMON OIL VARNISH.**—Resin, 4 lbs.; bees'-wax, $\frac{1}{2}$ lb.; boiled oil, $\frac{1}{2}$ gallon; mix with heat; then add spirits of turpentine, 2 quarts.

CHINESE VARNISH.—Mastic, 2 oz.; sandarach, 2 oz.; rectified spirit 1 pt.; close the matrass with bladder, with a pin hole for the escape of vapor; heat to boiling in a sand or water bath, and when dissolved, strain through linen.

METALLIC VARNISH FOR COACH BODIES.—Asphaltum, 56 lbs.; melt, then add litharge, 9 lbs., red lead, 7 lbs. Boil, then add boiled oil, 12 gals, yellow resin, 12 lbs. Again boil until, in cooling, the mixture may be rolled into pills; then add spts. of turpentine, 30 gals.; lampblack, 7 lbs. Mix well.

MASTIC VARNISH.—Mastic, 1 lb.; white wax, 1 oz.; spirits turpentine, 1 gallon; reduce the gums small; then digest it with heat in a close vessel till dissolved.

TURPENTINE VARNISH.—Resin, 1 lb.; boiled oil, 1 lb.; melt; then add turpentine, 2 lbs. Mix well.

PALE VARNISH.—Pale African copal, 1 part; fuse. Then add hot pale oil, 2 parts. Boil the mixture till it is stringy; then cool a little, and add spirits of turpentine, 3 parts.

LACQUER VARNISH.—A good lacquer is made by coloring lac-varnish with turmeric and annatto. Add as much of these two coloring substances to the varnish as will give the proper color; then squeeze the varnish through a cotton cloth, when it forms lacquer.

GOLD VARNISH.—Digest shellac, sixteen parts gum sandarach, mastic, of each three parts; crocus, one part; gum gamboge, two parts; all bruised, with alcohol, one hundred and forty-four parts. Or, digest seedlac, sandarach, mastic, of each eight parts; gamboge, two parts; dragon's blood, one part; white turpentine, six parts; turmeric, four parts; bruised with alcohol, one hundred and twenty parts.

DEEP GOLD-COLORED LACQUER.—Seed-lac, 3 oz.; turmeric, 1 oz.; dragon's blood, one-fourth ounce; alcohol, 1 pt.; digest for a week, frequently shaking; decant, and filter.

Lacquers are used upon polished metals and wood to impart the appearance of gold. If yellow is required, use turmeric, aloes, saffron or gamboge; for red, use annatto, or dragon's blood, to color. Turmeric, gamboge, and dragon's blood generally afford a sufficient range of colors.

GOLD LACQUER.—Put into a clean 4 gal. tin 1 lb. of ground turmeric, $1\frac{1}{2}$ oz. of gamboge, $3\frac{1}{2}$ lbs. powdered gum sandarach, $\frac{1}{2}$ pound of shellac, and 2 gal. of spirits of wine. When shaken, dissolved, and strained, add 1 pint of turpentine varnish, well mixed.

VARNISH FOR TOOLS.—Take tallow, 2 oz.; resin, 1 oz.; and melt together. Strain while hot, to get rid of specks which are in the resin; apply a slight coat on your tools with a brush, and it will keep off rust for any length of time.

GOLD VARNISH.—Turmeric, 1 dram; gamboge, 1 dram; turpentine, 2 pints; shellac, 5 oz.; sandarach, 5 oz.; dragon's blood, 8 drams; thin mastic varnish, 8 oz.; digest with occasional agitation for 14 days; then set aside to fine, and pour off the clear.

BOOKBINDERS' VARNISH.—Shellac, eight parts; gum benzoin, 3 parts; gum mastic, 2 parts; bruise, and digest in alcohol, 48 parts; oil of lavender, $\frac{1}{2}$ part. Or, digest shellac, 4 parts; gum mastic, 2 parts; gum dammer and white turpentine, of each 1 part; with alcohol (95 per cent.), 28 parts.

BEAUTIFUL PALE AMBER VARNISH.—Amber, pale and transparent, 6 lbs.; fuse; add hot clarified linseed oil, 2 gals.; boil till it strings strongly, cool a little, and add oil of turpentine, 4 gals. This soon becomes very hard, and is the most durable of oil-varnishes. When wanted to dry quicker, drying oil may be substituted for linseed, or "driers" may be added during the cooling.

BLACK COACH-VARNISH.—Amber, 1 lb.; fuse; add hot *drying* oil, $\frac{1}{2}$ pt.; powdered black resin and Naples asphaltum, of each 3 oz. When properly incorporated and considerably cooled, add oil of turpentine, 1 pt.

BODY VARNISH.—Finest African copal, 8 lbs.; fuse carefully; add clarified oil, 2 gals.; boil gently for $4\frac{1}{2}$ hours, or until quite stringy; cool a little, and thin with oil of turpentine, $3\frac{1}{2}$ gals. *Dries slowly.*

CARRIAGE VARNISH.—Sandarach, 19 oz.; pale shellac, 9 $\frac{1}{2}$ oz.; very pale transparent resin, $12\frac{1}{2}$ oz.; turpentine, 18 oz.; 85 per cent. alcohol, 5 pts.: dissolve. Used for the internal parts of carriage, &c. *Dries in ten minutes.*

CABINETMAKERS' VARNISH.—Very pale shellac, 5 lbs.; mastic, 7 oz.; alcohol, 90 per cent. 5 or 6 pts.; dissolve in the cold with frequent stirring. Used for French polishing, &c.

JAPANNERS' COPAL VARNISH.—Pale African copal, 7 lbs.; fuse; add clarified linseed oil, $\frac{1}{2}$ gal.; boil five minutes, remove it into the open air, add boiling oil of turpentine, 2 gals.; mix well, strain it into the cistern, and cover it up immediately. Used to varnish furniture, and by japanners, coach-makers, &c.

COPAL VARNISH.—Pale hard copal, 8 lbs.; add hot and pale drying oil, 2 gals.; boil till it strings strongly cool a little, and

thin with hot rectified oil of turpentine, 3 gals. ; and strain immediately into the store can. Very fine.

GOLD VARNISH OF WATIN, FOR GILDED ARTICLES.—Gumlac in grains, gamboge, dragon's-blood, and annotto, of each 12½ oz. ; saffron, 3½ oz. Each resin must be dissolved separately in 5 pts. of 90 per cent. alcohol, and 3 separate tinctures must be made with the dragon's blood and annotto in a like quantity of spirit ; and a proper proportion of each mixed together to produce the required shade.

VARNISH FOR PLASTER CASTS.—White soap and white wax, each ½ oz. ; water, 2 pts. ; boil together in a clean vessel for a short time. This varnish is to be applied when cold with a soft brush.

TRANSPARENT VARNISH FOR PLOUGHS, &c.—Best alcohol, 1 gal. ; gum sandarach, 2 lbs. ; gum mastic, ½ lb. ; place all in a tin can which admits of being corked ; cork tight, shake it frequently, occasionally placing the can in hot water. When dissolved, it is ready for use.

FINE BLACK VARNISH FOR COACHES.—Melt in an iron pot, amber, 32 oz. ; resin, 6 oz. ; asphaltum, 6 oz. ; drying linseed oil, 1 pt. ; when partly cooled, add oil of turpentine, warmed, 1 pint.

MORDANT VARNISH.—Dissolve 1 oz. mastic, 1 oz. sandarach, ½ oz. gum gamboge, and ¼ oz. turpentine in 6 oz. spirits turpentine. One of the simplest mordants is that procured by dissolving a little honey in thick glue. It has the effect of greatly heightening the color of the gold, and the leaf sticks extremely well.

CHANGING VARNISH.—*To imitate Gold or Silver, &c.* Put 4 oz. best gum gamboge into 32 oz. spirits of turpentine ; 4 oz. dragon's blood into 32 oz. spirits of turpentine, and 1 oz. of annotto into 8 oz. spirits of turpentine. Make the 3 mixtures in different vessels. Keep them in a warm place, exposed to the sun as much as possible, for about 2 weeks, when they will be fit for use. Add together such quantities of each liquor as the nature of the color you are desirous of obtaining will point out.

VARNISH, TRANSPARENT, FOR WOOD.—Best alcohol, 1 gal. ; nice gum shellac, 2½ lbs. Place the jug or bottle in a situation to keep it just a little warm, and it will dissolve quicker than if hot, or left cold.

PATENT VARNISH FOR WOOD OR CANVAS.—Take spirits of turpentine, 1 gal. ; asphaltum, 2½ lbs. ; put them into an iron kettle which will fit upon a stove, and dissolve the gum by heat. When dissolved and a little cool, add copal varnish, 1 pt. ; and boiled linseed oil, 1 pt. ; when cold, it is ready for use. Perhaps a little lamp-black would make it a more perfect black.

MOSAIC GOLD POWDER FOR BRONZING, &c.—Melt 1 lb. tin in a crucible, add ½ lb. of purified quicksilver to it : when this is cold, it is reduced to powder, and ground, with ½ lb. sal-ammoniac and 7 oz. flour of sulphur, till the whole is thoroughly mixed. They are then calcined in a matress ; and the sublimation of the other ingredients leaves the tin converted into the mosaic gold powder which is found at the bottom of the glass. Remove any black or discolored particles. The sal-ammoniac used must be very white and clear, and the mercury of the utmost purity. When a deeper

red is required, grind a very small quantity of red lead with the above materials.

TRUE GOLD POWDER.—Put some gold leaf, with a little honey, or thick gum water made with gum arabic, into an earthen mortar, and pound the mixture till the gold is reduced to very small particles; then wash out the honey or gum repeatedly with warm water, and the gold in powder will be left behind. When dry, it is fit for use.

DUTCH GOLD POWDER is made from Dutch gold leaf, which is sold in books at a very low price. Treat in the manner described above for true gold powder. When this inferior powder is used, cover the gilding with a coat of clear varnish, otherwise it will soon lose its bright appearance.

COPPER POWDER is prepared by dissolving filings or slips of copper with nitrous acid in a receiver. When the acid is saturated, the slips are to be removed; or, if filings be employed, the solution is to be poured off from what remains undissolved. Small bars are then put in, which will precipitate the copper powder from the saturated acid; and, the liquid being poured from the powder, this is to be washed clean off the crystals by repeated waters.

GENERAL DIRECTIONS FOR BRONZING.—The choice of the above powders is of course determined by the degree of brilliancy you wish to obtain. The powder is mixed with strong gum water or isinglass, and laid on with a brush or pencil; and, when not so dry as to have still a certain clamminess, a piece of soft leather wrapped round the finger is dipped in the powder, and rubbed over the work. When the work has been all covered with the bronze, it must be left to dry, and any loose powder then cleared away by a hair-pencil.

THE BRONZING OF PLASTER CASTS is effected by giving them a coat of oil or size varnish, and when this is nearly dry, applying with a dabber of cotton or a camel-hair pencil any of the metallic bronze powders; or the powder may be placed in a little bag of muslin, and dusted over the surface, and afterwards finished with a wad of linen. The surface must be afterwards varnished.

BRONZING IRON.—The subject should be heated to a greater degree than the hand can bear, and German gold, mixed with a small quantity of spirit of wine varnish, spread over it with the pencil; should the iron be already polished, you must heat it well, and moisten it with a linen rag dipped in vinegar.

FRENCH BURNISHED GILDING.—*Encollage*, or glue coat.—To a decoction of wormwood and garlic in water, strained through a cloth, a little common salt and some vinegar are added. This is mixed with as much good glue, and the mixture spread in a hot state with a brush of boar's hair. When plaster or marble is gilded, leave out the salt. The first glue-coating is made thinner than the second. 2. *White preparation* consists in covering the above surface with 8, 10, or 12 coats of Spanish white, mixed up with strong size; each well worked on with the brush. 3. *Stop up the pores* with thick whitening and glue, and smooth the surface with dog-skin. 4. *Polish* the surface with pumice-stone and very cold water. 5. *Retouch* the whole in a skilful manner. 6. *Cleanse* with a damp linen rag, and then a soft sponge. 7. *Rub* with a horse's tail

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(*shave-grass*) the parts to be yellowed, to make them softer. 8. *Yellow* with *yellow ochre* carefully ground in water, and mixed with transparent colorless size. Use the thinner part of the mixture with a fine brush. 9. Next rub the work with *shave-grass* to remove any granular appearance. 10. *Gold water size* consists of Armenian bole, 1 lb.; bloodstone (hematite), 2 oz.; and as much galena, each separately ground in water. Then mix all together with a spoonful of olive-oil. This is tempered with a white sheep-skin glue, clear and well strained. Heat, and apply three coats with a fine long-haired brush. 11. *Rub* with a clean dry linen cloth, except the parts to be burnished, which are to receive other 2 coats of the gold size, tempered with glue. 12. The surface, damped with cold water (iced in summer), has then the *gold leaf* applied to it. Gild the *hollow* ground before the more prominent parts; water being dexterously applied by a soft brush, immediately behind the gold leaf, before laying it down; removing any excess of water with a dry brush. 13. *Burnish* with bloodstone. 14. Next pass a thin coat of glue, slightly warmed, over the parts that are not to be burnished. 15. Next moisten any broken points with a brush, and apply bits of gold leaf to them. 16. Apply the *vermilion* coat very lightly over the gold leaf with a soft brush. It gives lustre and fire to the gold, and is made as follows: annatto, 2 oz.; gamboge, 1 oz.; vermilion, 1 oz.; dragon's-blood, $\frac{1}{2}$ oz.; salt of tartar, 2 oz.; saffron, 18 grs.; boil in 2 English pints of water, over a slow fire, till it is reduced to a fourth; then pass the whole through a silk or muslin sieve. 17. Next pass over the dead surfaces a second coat of deadening glue, hotter than the first. This finishes the work, and gives it strength.

BRONZING OR GILDING WOOD.—Pipeclay, 2 oz.; Prussian blue, patent yellow, raw umber, lampblack, of each, 1 oz.; grind separately with water on a stone, and as much of them as will make a good color put into a small vessel $\frac{3}{4}$ full of size. The wood, being previously cleaned and smoothed, and coated with a mixture of clean size and lampblack, receives a new coating twice successively with the above compound, having allowed the first to dry. Afterwards the bronze powder is to be laid on with a pencil, and the whole burnished or cleaned anew, observing to repair the parts which may be injured by this operation; next the work must be coated over with a thin layer of Castile soap, which will take the glare off the burnishing, and afterwards be carefully rubbed with a woollen cloth. The superfluous powder may be rubbed off when dry.

BRONZE POWDER of a *pale gold* color is produced from an alloy of 13 $\frac{1}{2}$ parts of copper and 2 $\frac{3}{4}$ parts zinc, of a *crimson metallic* lustre, from copper, of a *paler* color, copper, and a very little zinc; *green* bronze with a proportion of verdigris, of a fine *orange* color, by 14 $\frac{1}{2}$ parts copper and 1 $\frac{3}{4}$ zinc; another orange color, 13 $\frac{3}{4}$ parts copper and 2 $\frac{3}{4}$ zinc. The alloy is laminated into very fine leaves with careful annealing, and these are levigated into impalpable powders, along with a film of fine oil, to prevent oxidizement, and to favor the levigation.

REVIVER FOR GILT FRAMES.—White of eggs, 2 oz.; chloride of potash or soda, 1 oz.; mix well: blow off the dust from the frames;

then go over them with a soft brush dipped in the mixture, and they will appear equal to new.

GILDING ON WOOD.—To gild in oil, the wood, after being properly smoothed, is covered with a coat of *gold size*, made of drying linseed oil mixed with yellow ochre; when this has become so dry as to adhere to the fingers without soiling them, the gold leaf is laid on with great care and dexterity, and pressed down with cotton wool; places that have been missed are covered with small pieces of gold leaf, and when the whole is dry, the ragged bits are rubbed off with the cotton. This is by far the easiest mode of gilding: any other metallic leaves may be applied in a similar manner. *Pale leaf gold* has a greenish yellow color, and is an alloy of gold with silver. Dutch gold leaf is only copper leaf colored with the fumes of zinc; being much cheaper than true gold leaf, it is very useful when large quantities of gilding are required in places where it can be defended from the weather, as it changes color if exposed to moisture; and it should be covered with varnish. *Silver leaf* is prepared every way the same as gold leaf; but when applied, should be kept well covered with varnish, otherwise it is liable to tarnish; a transparent yellow varnish will give it the appearance of gold. Whenever gold is fixed by means of linseed oil, it will bear washing off, which burnished gold will not.

TO REMOVE OLD PUTTY.—Apply nitric or muriatic acid.

GLASS AND PORCELAIN GILDING.—Dissolve in boiled linseed oil an equal weight either of copal or amber; add as much oil of turpentine as will enable you to apply the compound or size thus formed, as thin as possible, to the parts of the glass intended to be gilt. The glass is to be placed in a stove till it will almost burn the fingers when handled: at this temperature the size becomes adhesive, and a piece of gold-leaf, applied in the usual way, will immediately stick. Sweep off the superfluous portions of the leaf, and when quite cold it may be burnished; taking care to interpose a piece of India paper between the gold and the burnisher.

SOLUBLE GLASS.—1. Silica, 1 part; carbonate of soda, 2 parts; fuse together. 2. Carbonate of soda (dry), 54 parts; dry carbonate of potassa, 70 parts; silica, 192 parts; soluble in boiling water, yielding a fine, transparent, semi-elastic varnish. 3. Carbonate of potassa (dry), 10 parts; powdered quartz (or sand, free from iron or alumina), 15 parts; charcoal, 1 part; all fused together. Soluble in 5 or 6 times its weight of *boiling* water. The filtered solution, evaporated to dryness, yields a transparent glass, permanent in the air.

ETCHING ON GLASS.—Druggists' bottles, bar-tumblers, signs, and glassware of every description, can be lettered in a beautiful style of art, by simply giving the article to be engraved, or etched, a thin coat of the engraver's varnish (see next receipt), and the application of fluoric acid. Before doing so, the glass must be thoroughly cleaned and heated, so that it can hardly be held. The varnish is then to be applied lightly over, and made smooth by dabbing it with a small ball of silk, filled with cotton. When dry and even, the lines may be traced on it by a sharp steel, cutting clear through the varnish to the glass. The varnish must be removed

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clean from each letter, otherwise it will be an imperfect job. When all is ready, pour on or apply the fluoric acid with a feather, filling each letter. Let it remain until it etches to the required depth, then wash off with water, and remove the varnish.

ETCHING VARNISH.—Take of virgin wax and asphaltum, each 2 oz.; of black pitch and Burgundy pitch, each $\frac{1}{2}$ oz.; melt the wax and pitch in a new earthenware glazed pot, and add to them, by degrees, the asphaltum, finely powdered. Let the whole boil, simmering gradually, till such time as, taking a drop upon a plate, it will break when it is cold, on bending it double two or three times betwixt the fingers. The varnish, being then boiled enough, must be taken off the fire, and, after it cools a little, must be poured into warm water that it may work the more easily with the hands, so as to be formed into balls, which must be kneaded, and put into a piece of taffety for use.

FLUORIC ACID, TO MAKE FOR ETCHING PURPOSES.—You can make your own fluoric (sometimes called hydro-fluoric) acid, by getting the fluor or Derbyshire spar, pulverizing it, and putting all of it into sulphuric acid which the acid will cut or dissolve. Inasmuch as fluoric acid is destructive to glass, it cannot be kept in common bottles, but must be kept in lead or gutta percha bottles.

GLASS-GRINDING FOR SIGNS, SHADES, &C.—After you have etched a name or other design upon uncolored glass, and wish to have it show off to better advantage by permitting the light to pass only through the letters, you can do so by taking a piece of flat brass sufficiently large not to dip into the letters, but pass over them when gliding upon the surface of the glass; then, with flour of emery, and keeping it wet, you can grind the whole surface, very quickly, to look like the ground-glass globes often seen upon lamps, except the letter, which is eaten below the general surface.

TO DRILL AND ORNAMENT GLASS.—Glass can be easily drilled by a steel drill, hardened but not drawn, and driven at a high velocity. Holes of any size, from the 16th of an inch upwards, can be drilled, by using spirits of turpentine as a drip; and, easier still, by using camphor with the turpentine. Do not press the glass very hard against the drill. If you require to ornament glass by turning in a lathe, use a good mill file and the turpentine and camphor drip, and you will find it an easy matter to produce any shape you choose.

GILDING GLASS SIGNS, &C.—Cut a piece of thin paper to the size of your glass, draw out your design correctly in black lead-pencil on the paper, then prick through the outline of the letters with a needle; tie up a little dry white lead in a piece of rag; this is a pounce-bag. Place your design upon the glass, right side up, dust it with the pounce-bag; and, after taking the paper off, the design will appear in white dots upon the glass; these will guide you in laying on the gold on the opposite side, which must be well cleaned preparatory to laying on the gold. *Preparing the size.*—Boil perfectly clean water in an enamelled saucepan, and while boiling, add 2 or 3 shreds of best selected isinglass; after a few minutes strain it through a clean linen rag; when cool, it is ready for use. *Clean the glass perfectly.*—When this is done, use a flat camel's-hair brush for laying on the size; and let it drain off when

you put the gold on. When the gold is laid on and perfectly dry, take a ball of the finest cotton wool and gently rub or polish the gold; you can then lay on another coat of gold if desirable; it is now ready for writing. In doing this, mix a little of the best vegetable black with black japan; thin with turpentine to proper working consistency; apply this when thoroughly dry; wash off the superfluous gold, and shade as in sign-writing.

GLASS GILDING, ANOTHER METHOD.—Clean and dry the glass thoroughly, then lay out the lines for the letters with a piece of hard scented soap, then paint the letters on the *right* side of the glass with lampblack mixed with oil, in order to *form a guide for the work*, then on the inside lay on a coat of the size mentioned in the preceding receipt, using a camel's-hair brush, covering the whole of the letters; next lay on the gold leaf with a tin, until every part of the letters is covered well. Let the leaf remain until the size is dry, when you will find that the letters on the front side can be easily seen and traced. This is done with quick drying black, mixed with a little varnish. Paint over the whole directly on the gold; allow it to dry; then wipe off with soap and water the lampblack letters from the front side, with pure cold water and a clean sponge; wash the superfluous gold leaf and size from the back, and you will have a splendid gold letter on the glass; next, shade your letters to suit the taste, always remembering to shade to the edge of the gold, for then you have only *one* edge to make straight. The other edge may be left rough, and when dry may be straightened by scraping with a knife.

ORNAMENTAL DESIGNS ON GLASS.—In making scrolls, eagles, &c., on glass, some painters put on the outlines and shades first, and then lay the gold leaf over all; another good way is to scratch the shades into the gold leaf after it is dry, and put the colors on the back of the gold. Silver leaf may be used in the same manner as gold, but it will not wear as well. A very pretty letter may be made by incorporating silver with gold; take paper and cut any fancy design to fit the parts of the letter; stick it on the size before laying the leaf, and then lay the leaf, allowing it to dry, and wash off as before; then with a penknife raise the paper figure, and the exact shape or form of the figure will be found cut out of the gold letter; clean off nicely, apply more size, and lay *silver* leaf to cover the vacant spots; wash off when dry, and a very handsome letter will be the result. Colors may be used instead of silver, if desired, or a silver letter edged or "cut up" with gold, will look well.

GILDERS' GOLD SIZE.—Drying or boiled linseed oil, thickened with yellow ochre, or calcined red ochre, and carefully reduced to the utmost smoothness by grinding. It is thinned with oil of turpentine.

TO GILD LETTERS ON WOOD, &C.—When your sign is prepared as smooth as possible, go over it with a sizing made by white of an egg dissolved in about four times its weight of cold water; adding a small quantity of fuller's earth, this to prevent the gold sticking to any part but the letters. When dry, set out the letters and commence writing, laying on the size as thinly as possible, with a sable pencil. Let it stand until you can barely feel a slight stickiness, then go to work with your gold leaf, knife, and cushion, and

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gild the letters. Take a leaf up on the point of your knife, after giving it a slight puff into the back part of your cushion, and spread it on the front part of the cushion as straight as possible, giving it another slight puff with your mouth to flatten it out. Now cut it into the proper size, cutting with the heel of your knife forwards. Now rub the tip lightly on your hair; take up the gold on the point, and place it neatly on the letters; when they are all covered get some very fine cotton wool, and gently rub the gold until it is smooth and bright. Then wash the sign with clean water to take off the egg size.

SUBSTITUTE FOR PLASTER OF PARIS.—Best whitening, 2 lbs.; glue, 1 lb.; linseed oil, 1 lb. Heat all together, and stir thoroughly. Let the compound cool, and then lay it on a stone covered with powdered whitening, and heat it well till it becomes of a tough and firm consistence; then put it by for use, covering with wet cloths to keep it fresh. When wanted for use, it must be cut in pieces adapted to the size of the mould, into which it is forced by a screw press. The ornament may be fixed to the wall, picture-frame, &c., with glue or white lead. It becomes in time as hard as stone itself.

GOLD LUSTRE FOR STONEWARE, CHINA, &C.—Gold, 6 parts; aqua regia, 36 parts. Dissolve, then add tin, 1 part; next add balsam of sulphur, 3 parts; oil of turpentine, 1 part. Mix gradually into a mortar, and rub it until the mixture becomes hard; then add oil of turpentine, 4 parts. It is then to be applied to a ground prepared for the purpose.

GILDING CHINA AND GLASS.—Powdered gold is mixed with borax and gum-water, and the solution applied with a camel-hair pencil. Heat is then applied by a stove until the borax fuses, when the gold is fixed and afterwards burnished.

GLASS STAINING.—The following colors, after having been prepared, and rubbed upon a plate of ground-glass, with the spirit of turpentine or lavender thickened in the air, are applied with a hair-pencil. Before using them, however, it is necessary to try them on small pieces of glass, and expose them to the fire, to ascertain if the desired tone of color is produced. The artist must be guided by these proof-pieces in using his colors. The glass proper for receiving these pigments should be colorless, uniform, and difficult of fusion. A design must be drawn on paper, and placed beneath the plate of glass. The upper side of the glass, being sponged over with gum-water, affords, when dry, a surface proper for receiving the colors without the risk of their running irregularly, as they would otherwise do on the slippery glass. The artist draws on the plate (usually in black), with a fine pencil, all the traces which mark the great outlines or shades of the figures. Afterwards, when it is dry, the vitrifying colors are laid on by means of larger hair-pencils; their selection being regulated by the burnt specimen-tints above mentioned. The following are all fast colors, which do not run, except the yellow, which must therefore be laid on the opposite side of the glass. The preparations being all laid on, the glass is ready for being fired in a muffle, in order to fix and bring out the proper colors. The muffle must be made of very refractory fire-clay, flat at its bottom, and only five or six

inches high, with a strong arched roof, and close on all sides, to exclude smoke and flame. On the bottom, a smooth bed of sifted lime, freed from water, about half an inch thick, must be prepared for receiving the glass. Sometimes, several plates of glass are laid over each other, with a layer of lime powder between each. The fire is now lighted, and very gradually raised, lest the glass should be broken; then keep it at a full heat for three or four hours, more or less, according to the indications of the trial slips; the yellow coloring being principally watched, it furnishing the best criterion of the state of the others. When all is right, let the fire die out, so as to anneal the glass.

STAINED-GLASS PIGMENTS.—No. 1. *Flesh-color.*—Red lead, 1 oz.; red enamel (Venetian glass enamel, from alum and copperas calcined together): grind them to a fine powder, and work this up with alcohol upon a hard stone. When slightly baked, this produces a fine flesh-color. No. 2. *Black color.*—Take 14½ oz. of smithy scales of iron; mix them with 2 oz. of white glass; antimony, 1 oz.; manganese, ½ oz.; pound and grind these ingredients together with strong vinegar. No. 3. *Brown color.*—White glass or enamel, 1 oz.; good manganese, ½ oz.; grind together. No. 4. *Red, Rose, and Brown colors* are made from peroxide of iron, prepared by nitric acid. The flux consists of borax, sand, and minium, in small quantities. *Red color* may likewise be obtained from 1 oz. of red chalk, pounded, mixed with 2 oz. of white, hard enamel, and a little peroxide of copper. A red may also be composed of rust of iron, glass of antimony, yellow glass of lead, such as is used by potters, or litharge, each in equal quantities, to which a little sulphuret of silver is added. This composition, well ground, produces a very fine red color on glass. No. 5. *Green.*—2 oz. of brass, calcined into an oxide; 2 oz. of minium, and 8 oz. of white sand; reduce them to a fine powder, which is to be enclosed in a well-luted crucible, and heated strongly in an air furnace for an hour. When the mixture is cold, grind it in a brass mortar. Green may, however, be advantageously produced, by a yellow on one side and a blue on the other. Oxide of chrome has been also employed to stain glass green. No. 6. *A fine Yellow stain.*—Take fine silver, laminated thin, dissolve in nitric acid, dilute with abundance of water, and precipitate with solution of sea-salt; mix this chloride of silver in a dry powder, with three times its weight of pipe clay, well burnt and pounded. The back of the glass pane is to be painted with this powder; for, when painted on the face, it is apt to run into the other colors. A pale yellow can be made by mixing sulphuret of silver with glass of antimony and yellow ochre, previously calcined to a red brown tint. Work all these powders together, and paint on the back of the glass. Or silver *lamine*, melted with sulphur and glass of antimony, thrown into cold water and afterwards ground to powder, afford a yellow. A pale yellow may be made with the powder resulting from brass, sulphur, and glass of antimony, calcined together in a crucible till they cease to smoke, and then mixed with a little burnt yellow ochre. The fine yellow of M. Meraud is prepared from chloride of silver, oxide of zinc, and rust of iron. This mixture, simply ground, is applied on the glass. *Orange color.*—Take part of silver powder, as precipitated from the nitrate of

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that metal, by plates of copper, and washed; mix with 1 part of red ochre, and 1 of yellow, by careful trituration; grind into a thin pap, with oil of turpentine or lavender; apply this with a brush, and burn in.

SILVERING LOOKING-GLASSES WITH PURE SILVER.—Prepare a mixture of 3 grs. of ammonia, 60 grs. nitrate of silver, 90 minims of spirits of wine, 90 minims of water; when the nitrate of silver is dissolved, filter the liquid, and add a small quantity of sugar, 15 grs.), dissolved in $1\frac{1}{2}$ oz. of water and $1\frac{1}{2}$ oz. spirits of wine. Put the glass into this mixture, having one side covered with varnish, gum, or some substance to prevent the silver being attached to it. Let it remain for a few days, and you have a most elegant looking-glass; yet it is far more costly than the quicksilver.

ANOTHER METHOD.—A sheet of tin-foil corresponding to the size of the plate of glass is evenly spread on a perfectly smooth and solid marble table, and every wrinkle on its surface is carefully rubbed down with a brush: a portion of mercury is then poured on, and rubbed over the foil with a clean piece of soft woollen stuff, after which, two rules are applied to the edges, and mercury poured on to the depth of a crown piece, when any oxide on the surface is carefully removed, and the sheet of glass, perfectly clean and dry, is slid along over the surface of the liquid metal, so that no air, dirt, or oxide can possibly either remain or get between them. When the glass has arrived at its proper position, gentle pressure is applied, and the table sloped a little to carry off the waste mercury; after which it is covered with flannel, and loaded with heavy weights; in twenty-four hours it is removed to another table, and further slanted, and this position is progressively increased during a month, till it becomes perpendicular.

PORCELAIN COLORS.—The following are some of the colors used in the celebrated porcelain manufactory of Sevres, and the proportions in which they are compounded. Though intended for porcelain painting, nearly all are applicable to painting on glass. **Flux No. 1** minium or red lead, 3 parts; white sand, washed, 1 part. This mixture is melted, by which it is converted into a greenish-coloured glass. **Flux No. 2. Gray flux.**—Of No. 1, 8 parts; fused borax in powder, 1 part. This mixture is melted. **Flux No. 3. For carmines and greens.**—Melt together fused borax, 5 parts; calcined flint, 3 parts; pure minium, 1 part. **No. 1. Indigo blue.**—Oxide of cobalt 1 part; flux No. 3, 2 parts. **Deep azure blue.**—Oxide of cobalt, 1 part, oxide of zinc, 2 parts; flux No. 3, 5 parts. **No. 2. Emerald Green.**—Oxide of copper, 1 part; antimonic acid, 10 parts; flux No. 1, 30 parts. Pulverize together, and melt. **No. 3. Grass green.**—Green oxide of chromium, 1 part; flux No. 3, 3 parts. Triturate and melt. **No. 4. Yellow.**—Antimonic acid, 1 part; subsulphate of the peroxide of iron, 8 parts; oxide of zinc, 4 parts; flux No. 1, 36 parts. Rub up together and melt. If this color is too deep the salt of iron is diminished. **No. 5. Fixed yellow for touches.**—No. 4, 1 part; white enamel of commerce, 2 parts. Melt and pour out; if not sufficiently fixed, a little sand may be added. **No. 6. Deep Nankin yellow.**—Subsulphate of iron, 1 part; oxide of zinc, 2 parts; flux No. 2, 8 parts. Triturate without melting. **No. 7. Deep red.**—Subsulphate of iron, calcined in a muffle until it be-

comes of a beautiful capucine red, 1 part; flux No. 2, 3 parts. Mix without melting. No. 8. *Liver brown*.—Oxide of iron made of a red brown, and mixed with three times its weight of flux No. 2. A tenth of sienna earth is added to it, if it is not deep enough. No. 9. *White*.—The white enamel of commerce, in cakes. No. 10. *Deep black*.—Oxide of cobalt, 2 parts; copper, 2 parts; oxide of manganese, 1 part; flux No. 1, 6 parts; fused borax, $\frac{1}{2}$ part. Melt, and add oxide of manganese, 1 part; oxide of copper, 2 parts. Triturate without melting. *The Application*.—Follow the general directions given in another part of this work, in relation to staining glass.

HOW TO WRITE ON GLASS IN THE SUN.—Dissolve chalk in aquafortis to the consistency of milk, and add to that a strong dissolution of silver. Keep this in a glass decanter well stopped. Then cut out from a paper the letters you would have appear, and paste the paper on the decanter or jar, which you are to place in the sun in such a manner that its rays may pass through the spaces cut out of the paper, and fall on the surface of the liquor. The part of the glass through which the rays pass will turn black, whilst that under the paper will remain white. Do not shake the bottle during the operation. Used for lettering jars.

TO TRANSFER PRINTS, ETC., TO GLASS OR WOOD.—Take of gum sandarach, 4 oz.; mastic, 1 oz.; Venice turpentine, 1 oz.; alcohol, 15 oz. Digest in a bottle, frequently shaking, and it is ready for use. Directions; use, if possible, good plate glass of the size of the picture to be transferred, go over it with the above varnish, beginning at one side, press down the picture firmly and evenly as you proceed, so that no air can possibly lodge between; put aside, and let dry perfectly, then moisten the paper cautiously with water, and remove it piecemeal by rubbing carefully with the fingers; if managed nicely, a complete transfer of the picture to the glass will be effected.

BOTTLE GLASS.—No. 1. *Dark Green*.—Fused glauber salts, 11 lbs.; soaper salts, 12 lbs.; waste soap-ashes, $\frac{1}{2}$ bush.; silicious sand, $\frac{1}{2}$ cwt.; glass-skimmings, 22 lbs. broken green glass, 1 cwt. to $1\frac{1}{2}$ cwt.; basalt, 25 lbs. to $\frac{1}{2}$ cwt. No. 2. *Pale Green*.—Pale sand, 100 lbs.; kelp, 35 lbs.; lixiviated wood ashes, $1\frac{1}{2}$ cwt.; fresh do., 40 lbs.; pipe-clay, $\frac{1}{2}$ cwt.; cullet, or broken glass, 1 cwt. No. 3. *Yellow or white sand*, 120 parts; wood-ashes, 80 parts; pearl-ashes, 20 parts; common salt, 15 parts; white arsenic, 1 part; very pale.

CRYSTAL GLASS.—No. 1. Refined potashes, 60 lbs.; sand, 120 lbs.; chalk, 24 lbs.; nitre and white arsenic, of each 2 lbs.; oxide of manganese, 1 to 2 oz. No. 2. Pure white sand, 120 parts; refined ashes, 70 parts; saltpetre, 10 parts; white arsenic, $\frac{1}{2}$ part; oxide of manganese, $\frac{1}{2}$ part. No. 3. Sand, 120 parts; red-lead, 50 parts; purified pearlash, 40 parts; nitre 20 parts; manganese, $\frac{1}{2}$ part.

FLASK GLASS (of St. Etienne).—Pure silicious sand, 61 parts; potash, $3\frac{1}{2}$ parts; lime, 21 parts; heavy spar, 2 parts; oxide of manganese, $q. s.$

BEST GERMAN CRYSTAL GLASS.—Take 120 lbs. of calcined flints or white sand; best pearlash, 70 lbs.; saltpetre, 10 lbs.; arsenic,

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$\frac{1}{2}$ lb.; and 5 oz. magnesia. No. 2. (*Cheaper.*) Sand or flint, 120 lbs.; pearlsh, 46 lbs.; nitre, 7 lbs.; arsenic, 6 lbs.; magnesia, 5 oz. This will require a long continuance in the furnace, as do all others when much of the arsenic is used.

PLATE GLASS.—No. 1. Pure sand, 40 parts; dry carbonate of soda, 26 $\frac{1}{2}$ parts; lime, 4 parts; nitre, 1 $\frac{1}{2}$ parts; broken plate glass, 25 parts. No. 2. *Ure's*.—Quartz-sand, 100 parts; calcined sulphate of soda, 24 parts; lime, 20 parts; cullet of soda-glass, 12 parts. No. 3. *Vienna*.—Sand, 100 parts; calcined sulphate of soda, 50 parts; lime, 20 parts; charcoal, 2 $\frac{1}{2}$ parts. No. 4. *French*.—White quartz sand and cullet, of each 300 parts; dry carbonate of soda, 100 parts; slacked lime, 43 parts.

CROWN GLASS.—No. 1. Sand, 300 lbs.; soda-ash, 200 lbs.; lime, 30 to 35 lbs.; 200 to 300 lbs. of broken glass. No. 2. (*Bohemian*).—Pure silicious sand, 63 parts; potash, 2 $\frac{1}{2}$ parts; lime, 12 parts; oxide of manganese, 1 part. No. 3. (*Prof. Schweigger*). Pure sand, 100 lbs.; dry sulphate of soda, 50 parts; dry quicklime in powder, 17 to 20 parts; charcoal, 4 parts. *Product*, white and good.

BEST WINDOW-GLASS.—No. 1. Take of white sand, 60 lbs.; purified pearlshes, 30 lbs.; of saltpetre, 15 lbs.; of borax, 1 lb.; of arsenic, $\frac{1}{2}$ lb. This will be very clear and colorless if the ingredients be good, and will not be very dear. No. 2. (*Cheaper*). White sand, 60 lbs.; unpurified pearlshes, 25 lbs.; of common salt, 10 lbs.; nitre, 5 lbs.; arsenic, 2 lbs.; magnesia, 1 $\frac{1}{2}$ oz. No. 3. *Common green window-glass*.—White sand, 60 lbs.; unpurified pearlshes, 30 lbs.; common salt, 10 lbs.; arsenic, 2 lbs.; magnesia, 2 oz.

LOOKING-GLASS PLATE.—No. 1. Cleansed white sand, 60 lbs.; pearlshes, purified, 25 lbs.; saltpetre, 15 lbs.; borax, 7 lbs. This composition should be continued long in the fire, which should be sometimes strong and afterwards more moderate, that the glass may be entirely free from bubbles before it be worked. No. 2. White sand, 60 lbs.; pearlshes 20 lbs.; common salt, 10 lbs.; nitre, 7 lbs.; borax, 1 lb. This glass will run with as little heat as the former; but it will be more brittle, and refract the rays of light in a greater degree. No. 3. Washed white sand, 60 lbs.; purified pearlshes, 25 lbs.; nitre, 15 lbs.; borax, 7 lbs. If properly managed, this glass will be colorless.

WINDOW GLASS.—No. 1. Dried sulphate of soda, 11 lbs.; soaper salts, 10 lbs.; lixiviated soap waste, $\frac{1}{2}$ bush.; sand, 50 to 60 lbs.; glass-pot skimmings, 22 lbs.; broken *pale green* glass, 1 cwt. No. 2. (*Paler*). White sand, 60 lbs.; pearlshes, 30 lbs.; common salt, 10 lbs.; arsenic, 10 lbs.; oxide of manganese, 2 to 4 oz. No. 3. (*Very Pale*). White sand, 60 lbs.; good pot ashes, 25 lbs.; common salt, 10 lbs.; nitre, 5 lbs.; arsenic, 2 lbs.; manganese, 2 to 4 oz. as required; broken *pale* window glass, 14 lbs.

COLORED GLASS.—*Fine Blue*. To 10 lbs. of flint glass, previously melted and cast into water, add saffer, 6 drs., $\frac{1}{2}$ oz. of calcined copper, prepared by putting sheet copper into a crucible, and exposing it to the action of a fire not strong enough to melt the copper, and you will have the copper in scales, which you pound. *Bright Purple*.—Use 10 lbs. flint glass as before; saffer, 5 drs., precipitate of calcium, 1 dr. *Gold Yellow*. Twenty-eight pounds flint glass,

and a quarter pound of the tartar which is found in urine; purify by putting it in a crucible in the fire till it smoke no more; add 2 ozs. of manganese.

PAPER FOR PHOTOGRAPHING—Wash the paper with a solution of nitrate of silver, 6 grains; distilled water, $\frac{1}{2}$ oz., dry the paper, and wash it with iodide of potassium, 5 grains; distilled water, $\frac{1}{2}$ oz.; dry with gentle heat; repeat the wash with the silver solution; and when dry, the paper is ready for use. The sensitive surface is an iodide for silver, and is easily affected by light.

COLORS FOR POTTERS' GLAZINGS.—*White*: prepare an intimate mixture of 4 parts of massicot, 2 of tin ashes, 3 fragments of crystal glass, and $\frac{1}{2}$ part of sea salt. The mixture is suffered to melt in earthenware vessels, when the liquid flux may be used. *Yellow*: take equal parts of massicot, red lead and sulphuret of antimony, calcine the mixture, and reduce it again to powder, add then 2 parts of pure sand, and $\frac{1}{2}$ parts of salt; melt the whole. *Green*: 2 parts of sand, 3 parts massicot, 1 part of salt and copper scales, according to the shade to be produced: melt and use. *Violet*: 1 part massicot, 3 parts sand, 1 of smalt, $\frac{1}{2}$ part of black oxide of manganese, melt. *Blue*: white sand and massicot, equal parts; blue smalt, $\frac{1}{2}$ part: melt. *Black*: black oxide of manganese, 2 parts; smalt, 1 part; burned quartz, 1 part; massicot, $\frac{1}{2}$ parts; melt. *Brown*: green bottle glass, 1 part; manganese, 1 part; lead, 2 parts; melt.

TO PRINT A PICTURE FROM THE PRINT ITSELF.—The page or picture is soaked in a solution, first of potassa, and then of tartaric acid. This produces a perfect diffusion of crystals of bitartrate of potassa through the texture of the unprinted part of the paper. As this salt resists oil, the ink roller may now be passed over the surface, without transferring any part of its contents except to the printed part.

TO CLEAN OLD OIL-PAINTINGS.—Dissolve a small quantity of salt in stale urine; dip a woollen cloth in the mixture, and rub the paintings over with it till they are clean; then wash them with a sponge and clean water; dry them gradually, and rub them over with a clean cloth. Should the dirt not be easily removed by the above preparation, add a small quantity of soft soap. Be very careful not to rub the paintings too hard.

TO RENEW OLD OIL-PAINTINGS.—The blackened lights of old pictures may be instantly restored to their original hue by touching them with deutoxide of hydrogen diluted with six or eight times its weight of water. The part must be afterwards washed with a clean sponge and water.

CAST ENGRAVINGS.—Take the engraved plate you wish to copy, and arrange a support of suitable materials round it: then pour on it the following alloy in a state of perfect fusion; tin, 1 part; lead, 64 parts; antimony, 12 parts. These "cast plates" may be worked off on a common printing press, and offer a ready mode of procuring cheap copies of the works of our celebrated artists.

MAGIC PAPER.—Take lard oil, or sweet oil, mixed to the consistence of cream, with either of the following paints, the color of which is desired: Prussian blue, lampblack, Venetian red, or chrome green, either of which should be rubbed with a knife on a plate or stone until smooth. Use rather thin but firm paper; put

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on with a sponge, and wipe off as dry as convenient; then lay them between uncolored paper, or between newspapers, and press by laying books or some other flat substance upon them until the surplus oil is absorbed, when it is ready for use.

TO MAKE GRINDSTONES FROM COMMON SAND.—River sand, 60 lbs.; shellac, 10 parts; powdered glass, 2 parts; melt in an iron pot, and cast into moulds.

TO CAST FIGURES IN IMITATION OF IVORY.—Make isinglass and brandy into a paste, with powdered egg-shells very finely ground. You may give it what color you choose; but cast it warm into your mould which you previously oil over; leave the figure in the mould till dry, and you will find on taking it out that it bears a very strong resemblance to ivory.

TO TAKE A PLASTER OF PARIS CAST FROM A PERSON'S FACE.—The person must lie on his back, and his hair be tied behind; into each nostril put a conical piece of paper, open at each end, to allow of breathing. The face is to be lightly oiled over, and the plaster, being properly prepared, is to be poured over the face, taking particular care that the eyes are shut, till it is a quarter of an inch thick. In a few minutes the plaster may be removed. In this a mould is to be formed, from which a second cast is to be taken, that will furnish casts exactly like the original.

TO ATTACH GLASS OR METAL LETTERS TO PLATE GLASS.—Copal varnish, 15 parts; drying oil, 5 parts; turpentine, 3 parts; oil of turpentine, 2 parts; liquified glue, 5 parts. Melt in a water bath, and add 10 parts of slacked lime.

TURNER'S CEMENT.—Bees' wax 1 oz.; resin, $\frac{1}{2}$ oz.; pitch, $\frac{1}{2}$ oz.; melt, and stir in fine brick dust.

BANK NOTE GLUE.—Dissolve 1 lb. of fine glue or gelatine in water; evaporate it till most of the water is expelled; add $\frac{1}{2}$ lb. of brown sugar, and pour it into moulds.

CEMENT FOR ELECTRICAL MACHINES AND GALVANIC TROUGHS.—Melt together 5 lbs. of resin and 1 lb. of bee's-wax, and stir in 1 lb. of red ochre (highly dried and still warm) and 4 oz. of plaster of Paris, continuing the heat a little above 212° , and stirring constantly till all frothing ceases, or (for troughs) rosin, 6 lbs.; dried red ochre, 1 lb.; calcined plaster of Paris, $\frac{1}{2}$ lb.; linseed oil, $\frac{1}{2}$ lb.

HYDRAULIC CEMENT.—Powdered clay, 3 lbs.; oxide of iron, 1 lb.; and boiled oil to form a stiff paste.

ENGINEERS' CEMENT.—Equal parts of red and white lead, with drying oil, spread on tow or canvas. An admirable composition for uniting large stones in cisterns.

STONE CEMENT.—River sand, 20 parts; litharge, 2 parts; quicklime, 1 part: mix with linseed oil.

BEST CEMENT FOR AQUARIA.—It is the same as that used in constructing the tanks of the Zoological Gardens, London. One part, by measure, say a gill of litharge; 1 gill of plaster of Paris; 1 gill of dry, white sand; $\frac{1}{4}$ a gill of finely powdered resin. Sift, and keep corked tight until required for use, when it is to be made into a putty by mixing in boiled oil (linseed) with a little patent drier added. Never use it after it has been mixed (that is, with the oil) over fifteen hours. This cement can be used for marine as well as fresh water aquaria as it resists the action of salt water. The

tank can be used immediately, but it is best to give it three or four hours to dry.

COMMON PASTE.—To a tablespoonful of flour add gradually $\frac{1}{2}$ pt. of cold water, and mix till quite smooth; add a pinch of powdered alum, some add a small pinch of powdered rosin, and boil for a few minutes, stirring constantly. The addition of a little brown sugar and a few grains of corrosive sublimate, will preserve it for years.

FOR LUTE, or cement for closing joints of apparatus, mix Paris plaster with water to a soft paste, and apply it immediately. It bears nearly a red heat. To render it impervious, rub it over with wax and oil.

ROMAN CEMENT.—Slacked lime, 1 bush., green copperas, $3\frac{1}{2}$ lbs., fine gravel sand, $\frac{1}{2}$ bush. Dissolve the copperas in hot water, and mix all together to the proper consistency for use; use the same day it is mixed, and keep stirring it continually with a stick while in use.

VICAT'S HYDRAULIC CEMENT is prepared by stirring into water a mixture of 4 parts chalk and 1 part clay; mix with a vertical wheel in a circular trough, letting it run out in a large receiver. A deposit soon takes place which is formed into small bricks, which, after being dried in the sun, are moderately calcined. It enlarges about $\frac{2}{3}$ when mixed with water.

GLUE.—Powdered chalk added to common glue strengthens it. A glue which will resist the action of water is made by boiling 1 lb. of glue in 2 qts. of skimmed milk.

CHEAP WATERPROOF GLUE.—Melt common glue with the smallest possible quantity of water; add, by degrees, linseed oil, rendered drying by boiling it with litharge. While the oil is being added, the ingredients must be well stirred, to incorporate them thoroughly.

FIRE AND WATERPROOF GLUE.—Mix a handful of quick-lime with 4 oz. of linseed oil; thoroughly lixiviate the mixture; boil it to a good thickness, and spread it on tin plates in the shade: it will become very hard, but can be dissolved over a fire, like common glue, and is then fit for use.

PREPARED LIQUID GLUE.—Take of best white glue, 16 oz.; white-lead, dry, 4 oz.; rain-water, 2 pts.; alcohol, 4 oz. With constant stirring, dissolve the glue and lead in the water, by means of a water-bath. Add the alcohol, and continue the heat for a few minutes. Lastly, pour into bottles, while it is still hot.

MASTIC CEMENT FOR COVERING THE FRONTS OF HOUSES.—Fifty parts, by measure, of clean dry sand, 50 of limestone (not burned) reduced to grains like sand, or marble dust, and 10 parts of red lead, mixed with as much boiled linseed oil as will make it slightly moist. The bricks, to receive it, should be covered with three coats of boiled oil, laid on with a brush, and suffered to dry before the mastic is put on. It is laid on with a trowel like plaster, but it is not so moist. It becomes hard as stone in a few months. Care must be exercised not to use too much oil.

CEMENT FOR TILE-ROOFS.—Equal parts of whiting and dry sand, and 25 per cent. of litharge, made into the consistency of putty with linseed oil. It is not liable to crack when cold, nor melt, like coal-tar and asphalt, with the heat of the sun.

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CEMENT FOR OUTSIDE OF BRICK WALLS.—Cement for the outside of brick walls, to imitate stone, is made of clean sand, 90 parts; litharge, 5 parts; plaster of Paris, 5 parts; moistened with boiled linseed oil. The bricks should receive two or three coats of oil before the cement is applied.

EXCELLENT CHEAP ROOFING.—SHINGLES SUPERSEDED.—Have your roof stiff, rafters made of stuff $1\frac{1}{2}$ by 8 inches, well supported and 6 feet apart, with ribs 1 inch by 2 inches, set edgewise, well nailed to the rafters, about 18 inches apart. The boards may be thin, but must be well seasoned, and nailed close together; this done, lay down and cover the roof with thin, soft, spongy straw paper used in making paper-boxes, which comes in rolls, and comes very low. Lay in courses up and down the roof, and lap over, nailing down with common No. 6 tacks, with leather under the heads like carpet-tacks. Then spread on several coatings of the following composition, previously boiled, stirred, and mixed together: good clean tar, 8 gals.; Roman cement, 2 gals. (or in its place very fine, clean sand may be used); resin, 5 lbs.; tallow, 3 lbs.; apply hot; and let a hand follow, and sift on sharp grit sand, pressing it into the tar composition. If wished fire-proof, go over the above with the following preparation: slake stone lime under cover with hot water till it falls into a fine powder, sift and mix 6 qts. of this with 1 qt. salt, add 2 gals. water, boil and skim. To 5 gals. of this add 1 lb. of alum, and $1\frac{1}{2}$ lb. of copperas, slowly, while boiling, $1\frac{1}{2}$ lbs. potash, and 4 qts. of clean, sharp sand, and any coloring desired. Apply a thick coat with a brush, and you have a roof which no fire can injure from the outside.

WATER LIME AT FIFTY CENTS PER BARREL.—Fine, clean sand, 100 lbs.; quick-lime in powder, 28 lbs.; bone ashes, 14 lbs.; for use, beat up with water, and use as quick as possible.

CEMENT FOR SEAMS IN ROOFS.—Take equal quantities of white lead and white sand, and as much oil as will make it into the consistency of putty. It will in a few weeks become as hard as stone.

TO MAKE DOOR PLATES.—Cut your glass the right size, and make it perfectly clean with alcohol or soap; then cut a strip of tin-foil sufficiently long and wide for the name, and with a piece of ivory or other burnisher rub it lengthwise to make it smooth; now wet the glass with the tongue (as saliva is the best sticking substance), or if the glass is very large, use a weak solution of gum arabic, or the white of an egg in half a pint of water, and lay on the foil, rubbing it down to the glass with a bit of cloth, then also with the burnisher; the more it is burnished the better will it look; now mark the width on the foil which is to be the height of the letter, and put on a straight edge, and hold it firmly to the foil, and with a sharp knife cut the foil, and take off the superfluous edges; then either lay out the letters on the back of the foil (so they shall read correctly on the front) by your own judgment, or by means of pattern letters, which can be purchased for that purpose; cut with the knife, carefully holding down the pattern or straight edge, whichever you use; then rub down the edge of all the letters with the back of the knife, or edge of the burnisher, which prevents the black paint or japan, which you next put over the back of the plate, from getting under the foil; having put a

line above and one below the name, or a border around the whole plate or not, as you bargain for the job. The japan is made by dissolving asphaltum in just enough turpentine to cut it; apply with a brush, as other paint, over the back of the letters, and over the glass forming a background. This is used on the iron plate of the frame also, putting it on when the plate is a little hot, and as soon as it cools, it is dry. A little lampblack may be rubbed into it if you desire it any blacker than it is without it.

SOLUBLE GLASS.—Powdered quartz, 15 parts; potash, 10 parts; charcoal, 1 part; these are melted together, worked in cold water, and then boiled with 5 parts water, in which they entirely dissolve. It is then applied to wood-work, or any other required substances.

TO RENDER WOOD INDESTRUCTIBLE.—*Robbins's Process.* This seems to be a process of inestimable value, and destined to produce very important results. The apparatus used consists of a retort or still, which can be made of any size or form, in which resin, coal tar, or other oleaginous substances, together with water, are placed in order to subject them to the action of the heat. Fire being applied beneath the retort containing the coal tar, &c., oleaginous vapor commences to rise, and pass out through a connecting pipe into a large iron tank or chamber (which can also be built of any size), containing the timber, &c., to be operated upon. The heat acts at once on the wood, causing the sap to flow from every pore, which, rising in the form of steam, condenses on the body of the chamber, and discharges through an escape pipe in the lower part. In this process a temperature of 212° to 250° Fahr is sufficient to remove the surface moisture from the wood; but after this the temperature should be raised to 300° or more, in order to completely saturate and permeate the body of the wood with the antiseptic vapors and heavier products of the distillation. The hot vapor coagulates the albumen of the wood, and opens the pores, so that a large portion of the oily product or creosote is admitted; the contraction resulting from the cooling process hermetically seals them, and decay seems to be almost impossible. There is a man-hole in the retort, used to change or clean out the contents; and the wood chamber is furnished with doors made perfectly tight. The whole operation is completed in less than one hour, rendering the wood proof against rot, parasites, and the attacks of the *Teredo navalis* or naval worm.

GERMAN STONE COATING FOR WOOD.—Chalk, 40 parts; rosin, 50 parts; linseed oil, 4 parts; melt together. To this add 1 part of oxide of copper, afterwards 1 part of sulphuric acid; add this last carefully; apply with a brush

WATCHMAKERS, JEWELLERS, GILDERS, &c., RECEIPTS.

ON WATCH CLEANING.—It is hardly necessary to say that great caution must be observed in taking the watch down; that is, in separating its parts. If you are new at the business think before

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you act, and then act slowly. Take off the hands carefully, so as not to bend the slender pivots upon which they work; this will be the first step. Second, loosen and lift the movement from the case. Third, remove the dial and dial wheels. Fourth, let down the mainspring by placing your bench key upon the arbor, or "winding post," and turning as though you were going to wind the watch until the click rests lightly upon the ratchet; then with your screw-driver press the point of the click away from the teeth, and ease down the springs. Fifth, draw the screws (or pins) and remove the bridges of the train, or the upper plate, as the case may be. Sixth, take out the balance. Great care must be observed in this, or you will injure the hair-spring. The stud or little square post into which the hair-spring is fastened may be removed from the bridge or plate of most modern watches, without unkeying the spring, by slipping a thin instrument, as the edge of a knife blade, under the corner of it and prying upward. This will save you a considerable amount of trouble, as you will not have the hair-spring to adjust when you reset the balance.

If the watch upon which you propose to work has an upper plate, as an American or an English lever for instance, loosen the lever before you have entirely separated the plates, otherwise it will hang and most likely be broken.

Having the machine now down, brush the dust away from its different parts and subject them to a careful examination with your eye-glass. Assure yourself that the teeth of the wheels and leaves of the pinions are all perfect and smooth; that the pivots are all straight, round, and highly polished; that the holes through which they are to work are not too large, and have not become oval in shape; that every jewel is smooth and perfectly sound; and that none of them are loose in their settings. See also that the escapement is not too deep or too shallow; that the lever or cylinder is perfect; that all the wheels have sufficient play to avoid friction, but not enough to derange their coming together properly; that none of them work against the pillar-plate; that the balance turns horizontally and does not rub; that the hair-spring is not bent or wrongly set so that the coils rub on each other, on the plate, or on the balance; in short, that everything about the whole movement is just as reason would teach you it should be. If you find it otherwise, proceed to repair in accordance with a carefully weighed judgment and the processes given in this chapter, after which, clean; if not, the watch only needs to be cleaned, and, therefore, you may go ahead with your work at once.

To CLEAN.—Many watchmakers wet the pillar plates and bridges with saliva, and then, dipping the brush into pulverized chalk or Spanish whiting, rub vigorously until they appear bright. This is not a good plan, as it tends to remove the plating and roughen the parts, and the chalk gets into the holes and damages them, or sticks around the edges of the wheel-beds. The best process is to simply blow your breath upon the plate or bridge to be cleaned, and then to use your brush with a little prepared chalk. (See recipe for preparing it.) The wheels and bridges should be held between the thumb and finger in a piece of soft paper while under-

going the process, otherwise the oil from the skin will prevent them becoming clean. The pinions may be cleaned by sinking them several times into a piece of pith, and the holes by turning a nicely shaped piece of pivot wood into them, first dry, and afterwards oiled a very little with watch oil. When the holes pass through jewels, you must work gently to avoid breaking them.

The oiling above named is all the watch will need. A great fault with many watchmakers lies in their use of too much oil.

THE "CHEMICAL PROCESS."—Some watchmakers employ what they call the "Chemical Process" to clean and remove discoloration from watch movements. It is as follows:—

Remove the screws and other steel parts; then dampen with a solution of oxalic acid and water. Let it remain a few moments, after which immerse in a solution made of one-fourth pound cyanuret potassa to one gallon rain water. Let remain about five minutes, and then rinse well with clean water, after which you may dry in sawdust, or with a brush and prepared chalk, as suits your convenience. This gives the work an excellent appearance.

TO PREPARE CHALK FOR CLEANING.—Pulverize your chalk thoroughly, and then mix it with clear rain water in the proportion of two pounds to the gallon. Stir well, and then let stand about two minutes. In this time the gritty matter will have settled to the bottom. Pour the water into another vessel, slowly so as not to stir up the settleings. Let stand until entirely settled, and then pour off as before. The settleings in the second vessel will be your prepared chalk, ready for use as soon as dried.

Spanish whiting, treated in the same way, makes a very good cleaning or polishing powder. Some operatives add a little jeweller's rouge, and we think it an improvement; it gives the powder a nice color at least, and therefore adds to its importance in the eyes of the uninitiated. In cases where a sharper polishing powder is required, it may be prepared in the same way from rotten stone.

PIVOT WOOD.—Watchmakers usually buy this article of watch-material dealers. A small shrub known as Indian arrow-wood, to be met with in the northern and western states, makes an excellent pivot wood. It must be cut when the sap is down, and split into quarters so as to throw the pith outside of the rod.

PITH FOR CLEANING.—The stalk of the common mullein affords the best pith for cleaning pinions. Winter, when the stalk is dry, is the time to gather it. Some use cork instead of pith, but it is inferior.

TO PIVOT.—When you find a pivot broken, you will hardly be at a loss to understand that the easiest mode of repairing the damage is to drill into the end of the pinion or staff, as the case may be, and having inserted a new pivot, turn it down to the proper proportions. This is by no means a difficult thing when the piece to be drilled is not too hard, or when the temper may be slightly drawn without injury to the other parts of the article.

TO TELL WHEN THE LEVER IS OF PROPER LENGTH.—You may readily learn whether or not a lever is of proper length, by measuring from the guard point to the pallet staff, and then comparing with the roller or ruby-pin table; the diameter of the table should

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always be just half the length measured on the lever. The rule will work both ways, and may be useful in cases where a new ruby-pin table has to be supplied.

TO CHANGE DEPTH OF LEVER ESCAPEMENT.—If you are operating on a fine watch, the best plan is to put a new staff into the lever, cutting its pivots a little to one side, just as far as you desire to change the escapement. Common watches will not, of course, justify so much trouble. The usual process in their case is to knock out the staff, and with a small file cut the hole oblong in a direction opposite to that in which you desire to move your pallets; then replace the staff, wedge it to the required position, and secure by soft soldering.

In instances where the staff is put in with a screw, you will have to proceed differently. Take out the staff, prize the pallets from the lever, file the pin holes to slant in the direction you would move the pallets, without changing their size on the other side of the lever. Connect the pieces as they were before, and, with the lever resting on some solid substance, you may strike lightly with your hammer until the bending of the pins will allow the pallets to pass into position.

TO TELL WHEN THE LEVER PALLETS ARE OF PROPER SIZE.—The clear space between the pallets should correspond with the outside measure, on the points of three teeth of the scape wheel. The usual mode of measuring for new pallets is to set the wheel as close as possible to free itself when in motion. You can arrange it in your depthing tool, after which a measurement between the pivot holes of the two pieces, on the pillar plate, will show you exactly what is required.

TO LENGTHEN LEVERS OF ANCHOR-ESCAPEMENT WATCHES WITHOUT HAMMERING OR SOLDERING.—Cut square across with a screw-head file, a little back from the point above the fork, and, when you have thus cut into it to a sufficient depth, bend forward the desired distance the piece thus partially detached. In the event of the piece snapping off while bending—which, however, rarely happens—file down the point level with the fork, and insert a pin, English lever style.

TO TEMPER CASE AND OTHER SPRINGS OF WATCHES.—Draw the temper from the spring, and fit it properly in its place in the watch; then take it out and temper it hard in rain-water (the addition of a little table-salt to the water will be an improvement); after which place it in a small sheet-iron ladle or cup, and barely cover it with linseed-oil; then hold the ladle over a lighted lamp until the oil ignites; let it burn until the oil is nearly, not quite consumed; then re-cover with oil and burn down as before; and so a third time; at the end of which, plunge it again into water. Main and hair-springs may, in like manner, be tempered by the same process; first draw the temper, and properly coil and clamp to keep in position, and then proceed the same as with case-springs.

TO MAKE RED WATCH HANDS.—1 oz. carmine, 1 oz. muriate of silver, $\frac{1}{2}$ oz. tinner's japan; mix together in an earthen vessel, and hold over a spirit-lamp until formed into a paste. Apply this to the watch hand, and then lay it on a copper plate, unce-

side up, and heat the plate sufficiently to produce the color desired.

TO DRILL INTO HARD STEEL.—Make your drill oval in form, instead of the usual pointed shape, and temper as hard as it will bear without breaking; then roughen the surface where you desire to drill with a little diluted muriatic acid, and, instead of oil, use turpentine or kerosene, in which a little gum camphor has been dissolved, with your drill. In operating, keep the pressure on your drill firm and steady; and if the bottom of the hole should chance to become burnished, so that the drill will not act, as sometimes happens, again roughen with diluted acid as before: then clean out the hole carefully, and proceed again.

TO CASE-HARDEN IRON.—If you desire to harden to any considerable depth, put the article into a crucible with cyanide of potash, cover over and heat altogether, then plunge into water. This process will harden perfectly to the depth of one or two inches.

TO PUT TEETH IN WATCH OR CLOCK WHEELS WITHOUT DOVETAILING OR SOLDERING.—Drill a hole somewhat wider than the tooth, square through the plate, a little below the base of the tooth; cut from the edge of the wheel square down to the hole already drilled; then flatten a piece of wire so as to fit snugly into the cut of the saw, and with a light hammer form a head on it like the head of a pin. When thus prepared, press the wire or pin into position in the wheel, the head filling the hole drilled through the plate, and the end projecting out so as to form the tooth; then with a sharp pointed graver cut a small groove each side of the pin from the edge of the wheel down to the hole, and with a blow of your hammer spread the face of the pin so as to fill the grooves just cut. Repeat the same operation on the other side of the wheel, and finish off in the usual way. The tooth will be found perfectly riveted in on every side, and as strong as the original one, while in appearance it will be equal to the best dovetailing.

TO TIGHTEN A CANNON PINION ON THE CENTRE ARBOR WHEN TOO LOOSE.—Grasp the arbor lightly with a pair of cutting nippers, and, by a single turn of the nippers around the arbor, cut or raise a small thread thereon.

TO FROST WATCH MOVEMENTS.—Sink that part of the article to be frosted for a short time in a compound of nitric acid, muriatic acid and table salt, one ounce of each. On removing from the acid, place it in a shallow vessel containing enough sour beer to merely cover it, then with a fine scratch brush scour thoroughly, letting it remain under the beer during the operation. Next wash off, first in pure water and then in alcohol. Gild or silver in accordance with any recipe in the plating department.

RULE FOR DETERMINING THE CORRECT DIAMETER OF A PINION BY MEASURING TEETH OF THE WHEEL THAT MATCHES INTO IT.—The term **FULL**, as used below, indicates full measure from outside to outside of the teeth named, and the term **CENTRE**, the measure from centre of one tooth to centre of the other tooth named, inclusive.

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For diameter of a pinion of 14 leaves measure, with calipers, a shade less than 6 teeth of the wheel, *centre*.

For diameter of a pinion of 12 leaves measure, with calipers, 5 teeth of the wheel, *centre*.

For diameter of a pinion of 10 leaves measure, with calipers, 4 teeth of the wheel, *full*.

For diameter of a pinion of 9 leaves measure, with calipers, a little less than 4 teeth of the wheel, *full*.

For diameter of a pinion of 8 leaves measure, with calipers, a little less than 4 teeth of the wheel, *centre*.

For diameter of a pinion of 7 leaves measure, with calipers, a little less than 3 teeth of the wheel, *full*.

For diameter of a pinion of 6 leaves measure, with calipers, 3 teeth of the wheel, *centre*.

For diameter of a pinion of 5 leaves measure, with calipers, 3 teeth of the wheel, *centre*.

For diameter of a pinion of 4 leaves measure, with calipers, one half of one space over 2 teeth of the wheel, *full*.

As a general rule, pinions that lead, as in the hour wheel, should be somewhat larger than those that drive, and pinions of clocks should generally be somewhat larger proportionally than those of watches.

TO POLISH WHEELS PERFECTLY WITHOUT INJURY.—Take a flat burnishing file, warm it over a spirit lamp, and coat it lightly with bees'-wax. When cold, wipe off as much of the wax as can be readily removed, and with your file thus prepared, polish the wheel, resting the wheel while polishing on a piece of cork. The finish produced will be quite equal to the finest buff polish, while there will be no clogging, and the edges of the arms and teeth will remain perfectly square.

RULES FOR DETERMINING THE CORRECT LENGTH OF THE LEVER, SIZE OF RUBY-PIN TABLE, SIZE OF THE PALLETS, AND DEPTH OF ESCAPEMENT OF LEVER WATCHES.—A lever, from the guard point to the pallet staff, should correspond in length with twice the diameter of the ruby-pin table, and when a table is accidentally lost, the correct size thereof may be known by measuring half the length of the lever between the points above named. For correct size of pallet, the clear space between the pallets should correspond with the outside measure on the points of three teeth of the escapement wheel. The only rule that can be given, without the use of diagrams, for correct depth of the escapements, is to set it close as it will bear, and still free itself perfectly when in motion. This may be done by first placing the escapement in your depthing tool, and then setting it to the correct depth. Then by measuring the distance between the pivots of the lever staff and escapement wheel, as now set, and the corresponding pivot holes in the watch, you determine correctly how much the depth of the escapement requires to be altered.

TO REMOVE RUST FROM IRON OR STEEL, &C.—For cleaning purposes, &c., kerosene oil or benzine are probably the best things known. When articles have become pitted by rust, however, these can of course, only be removed by mechanical means, such as scouring with fine powder, or flour of emery and oil, or with very

fine emery paper. To prevent steel from rusting, rub it with a mixture of lime and oil, or with mercurial ointment, either of which will be found valuable.

TO PUT WATCHES IN BEAT.—If a cylinder escapement, or a detached lever, put the balance into a position, then turn the regulator so that it will point directly to the pivot-hole of the pallet staff, if a lever, or of the scape-wheel, if a cylinder. Then lift out the balance with its bridge or clock, turn it over and set the ruby-pin directly in line with the regulator, or the square cut of the cylinder at right angles with it. Your watch will then be in perfect beat.

In case of an American or an English lever, when the regulator is placed upon the plate, you will have to proceed differently. Fix the balance into its place, cut off the connection of the train, if the mainspring is not entirely down, by slipping a fine broach into one of the wheels, look between the plates and ascertain how the lever stands. If the end farthest from the balance is equidistant between the two brass pins, it is all right; if not, change the hair-spring till it becomes so.

If dealing with a duplex watch, you must see that the roller notch, when the balance is at rest, is exactly between the locking tooth and the line of centre; that is, a line drawn from the centre of the roller to the centre of the scape-wheel. The balance must start from its rest and move through an arc of about ten degrees before bringing the locking tooth into action.

TO PREVENT A CHAIN RUNNING OFF THE FUSEE.—In the first place, you must look and ascertain the cause of the difficulty. If it results from the chain being too large, the only remedy is a new chain. If it is not too large, and yet runs off without any apparent cause, change it end for end—that will generally make it go all right. In cases where the channel in the fusee has been damaged and is rough, you will be under the necessity of dressing it over with a file the proper size and shape. Sometimes you find the chain naturally inclined to work away from the body of the fusee. The best way to remedy a difficulty of this kind is to file off a very little from the outer lower edge of the chain the entire length; this, as you can see, will incline it to work on instead of off. Some workmen, when they have a bad case and a common watch, change the standing of the fusee so as to cause the winding end of its arbor to incline a little from the barrel. This, of course, cannot do otherwise than make the chain run to its place.

TO WEAKEN THE HAIR-SPRING.—This is often effected by grinding the spring down. You remove the spring from the collet, and place it upon a piece of pivot wood cut to fit the centre coil. A piece of soft steel wire, flattened so as to pass freely between the coils, and armed with a little pulverized oil-stone and oil, will serve as your grinder, and with it you may soon reduce the strength of the spring. Your operations will, of course, be confined to the centre coil, for no other part of the spring will rest sufficiently against the wood to enable you to grind it, but this will generally suffice. The effect will be more rapid than one would suppose, therefore it will stand you in hand to be careful, or you may get the spring too weak before you suspect it.

SHOWING

Tra

No. of Teeth in the Centre Wheel.

72
66
66
66
66
66
66

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63
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Tra

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70
70
70

LIST OF TRAINS OF WATCHES.

SHOWING THE NUMBER OF TEETH IN THE WHEELS, LEAVES IN THE PINIONS BEATS IN A MINUTE, AND TIME THE FOURTH WHEEL REVOLVES IN.

Trains, for Seven Teeth in the Escapement Wheel.

No. of Teeth in the Centre Wheel.	Teeth in 3d Wheel.	Leaves in 3d Wheel Pinion.	Teeth in 4th Wheel.	Leaves in 4th Wheel Pinion.	Teeth in the Escapement Wheel.	Leaves in the Escapement Wheel Pinion.	No. of Beats in one minute.	No. of Seconds the 4th Wheel revolves in.
72	66	6	58	6	7	6	298—	27
66	64	6	64	6	7	6	292+	31
66	64	6	63	6	7	6	287+	31
66	63	6	63	6	7	6	283—	31
66	63	6	62	6	7	6	278+	31
66	63	6	61	6	7	6	274—	31
66	63	6	60	6	7	6	269+	31

Trains, for Nine Teeth in the Escapement Wheel.

63	60	6	57	6	9	6	299+	34
66	60	6	54	6	9	6	297	33
63	60	6	56	6	9	6	294	34
66	60	6	53	6	9	6	291+	33
63	60	6	55	6	9	6	289—	34
66	60	6	52	6	9	6	286	33
63	60	6	54	6	9	6	283+	34
66	60	6	51	6	9	6	280+	33
63	60	6	53	6	9	6	278+	34
66	60	6	50	6	9	6	275	33
63	60	6	52	6	9	6	273	34

Trains, for Eleven Teeth in the Escapement Wheel.

60	60	6	49	6	11	6	300—	36
60	54	6	54	6	11	6	297	40
60	56	6	52	6	11	6	290—	39
64	52	6	52	6	11	6	294—	39
58	56	6	53	6	11	6	292+	40
60	54	6	53	6	11	6	291+	40
62	54	6	51	6	11	6	290—	39
58	54	6	54	6	11	6	287+	41
58	55	6	53	6	11	6	287	41
59	54	6	53	6	11	6	286+	41
60	54	6	52	6	11	6	286	40
60	55	6	51	6	11	6	286—	39
61	55	6	50	6	11	6	285—	39
63	55	6	48	6	11	6	282+	38
59	54	6	52	6	11	6	281+	41
60	54	6	51	6	11	6	281+	40
61	54	6	50	6	11	6	280—	39
56	54	6	54	6	11	6	277+	43
60	60	6	48	6	11	6	293+	36
62	54	6	52	6	11	6	295+	39
63	54	6	50	6	11	6	289—	39
63	48	6	56	6	11	6	287+	43
70	70	7	56	7	11	7	293+	36
70	70	7	48	7	11	6	293+	36
70	60	7	48	6	11	6	291+	36

1466 WATCHMAKER, JEWELLERS, &C., RECEIPTS.

No. of Teeth in the Centre Wheel.	Teeth in 3d Wheel.	Leaves in 3d Wheel Pinion.	Teeth in 4th Wheel.	Leaves in 4th Wheel Pinion.	Teeth in the Escapement Wheel.	Leaves in the Escapement Wheel Pinion.	No. of Beats in one Minute.	No. of Seconds the 4th Wheel revolves in.
60	70	6	48	7	11	6	293+	38
63	50	6	56	7	11	6	287+	40
63	63	6	50	7	11	6	289-	38
80	80	8	64	8	11	8	293+	36
80	80	8	56	8	11	7	293+	36
80	80	8	48	8	11	6	293+	36
81	70	8	56	7	11	7	293+	36
81	70	8	48	7	11	6	293+	36
80	60	8	48	7	11	6	293+	36
70	80	7	56	8	11	7	293+	33
70	80	7	48	8	11	6	293+	33
60	80	6	48	8	11	6	293+	33
84	72	8	50	8	11	6	289-	33
84	63	8	50	7	11	6	289-	33
84	54	8	50	6	11	6	289-	33
63	72	6	50	8	11	6	289-	33
63	63	6	50	7	11	6	289-	33
84	64	8	56	8	11	6	287+	40
84	56	8	56	7	11	6	287+	40
84	48	8	56	6	11	6	287+	40
63	64	6	56	8	11	6	287+	40
63	56	6	56	7	11	6	287+	40

Trains, for Thirteen Teeth in the Escapement Wheel.

54	53	6	52	6	13	6	298+	45
56	53	6	50	6	13	6	298-	44
59	51	6	49	6	13	6	296-	43
60	51	6	48	6	13	6	294+	42
64	53	6	51	6	13	6	293-	45
56	53	6	49	6	13	6	292-	44
56	54	6	48	6	13	6	291+	44
57	53	6	48	6	13	6	291-	43
54	52	6	51	6	13	6	287+	46
54	48	6	50	6	13	6	287+	45
50	51	6	50	6	13	6	286+	45
51	52	6	50	6	13	6	282-	46
56	51	6	49	6	13	6	281-	45
57	51	6	48	6	13	6	280-	44
52	52	6	51	6	13	6	277-	48
53	52	6	50	6	13	6	276+	46
52	52	6	52	6	13	6	293-	46
55	51	6	51	6	13	6	287	46
56	50	6	51	6	13	6	286+	46
56	52	6	48	6	13	6	280+	44
56	52	6	50	6	13	6	292+	44
60	48	6	48	6	13	6	277+	45
60	50	6	48	6	13	6	289-	43
60	54	6	60	8	13	6	292+	53
60	58	7	56	7	13	6	287+	51
60	60	8	54	6	13	6	300	44
62	56	7	56	7	13	6	296+	47
63	52	7	51	6	13	6	285	60
63	60	7	60	7	13	6	290	60
64	60	7	60	7	13	6	285	60
72	70	8	68	8	13	6	280	60
74	68	8	68	8	13	6	286+	60

Trains

No. of Teeth in the Centre Wheel.

54
58
48
48
48
56
63
60
62
72
72
72
62
54
72
72
72
63
63

Trains

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80
64
64

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Trains, for Fifteen Teeth in the Escapement Wheel.

No. of Seconds in the 4th Wheel revolves in.	No. of Teeth in the Centre Wheel.	Teeth in 3d Wheel.	Leaves in 3d Wheel Pinion.	Teeth in 4th Wheel	Leaves in 4th Wheel Pinion.	Teeth in the Escapement Wheel.	Leaves in the Escapement Wheel Pinion.	No. of Beats in one Minute.	No. of Seconds the 4th Wheel revolves in.
38	54	50	6	48	6	15	6	286	48
40	54	48	6	46	6	15	6	290	50
38	54	45	6	59	6	15	6	291—	60
36	48	45	6	58	6	15	6	300	62
36	48	45	6	57	6	15	6	288	62
34	48	45	6	56	6	15	6	288	50
33	56	48	6	46	6	15	6	289—	50
31	63	56	7	56	7	15	7	288	50
33	60	56	8	58	7	15	6	288	50
33	62	60	8	60	8	15	6	288	50
33	72	64	8	50	8	15	6	288	50
33	72	64	8	56	8	15	7	288	50
33	72	64	8	64	8	15	8	288	50
38	52	50	6	48	6	15	6	288	50
38	54	48	6	48	6	15	6	288	50
40	72	64	8	48	8	16	6	288	50
40	72	80	8	64	10	15	8	288	50
40	72	80	8	56	10	15	7	288	50
40	72	80	8	48	10	15	6	288	50
40	63	80	7	64	10	15	8	288	50
40	63	80	7	56	10	15	7	288	50
40	63	80	7	48	10	15	6	288	50

Wheel.

Trains, for Seventeen Teeth in the Escapement Wheel.

45	64	80	8	48	10	17	6	299+	53
44	54	48	6	44	6	17	6	299+	50
43	51	48	6	45	6	17	6	295+	53
42	54	48	6	43	6	17	6	292+	50
45	48	48	6	48	6	17	6	290+	53
44	51	48	6	45	6	17	6	289	53
43	54	48	6	42	6	17	6	286—	53
46	48	48	6	47	6	17	6	284+	53
45	51	48	6	44	6	17	6	282—	53
45	48	48	6	46	6	17	6	278	53
48	48	48	6	45	6	17	6	272	53
44	64	64	8	64	8	17	8	290+	50
43	72	64	8	56	8	17	8	286	50
46	64	64	8	60	8	17	8	289	53
46	56	56	7	56	7	17	7	290+	53
46	63	56	7	49	7	17	7	286—	50
48	64	56	8	48	7	17	6	290+	53
48	80	80	10	64	10	17	8	290+	53
44	80	64	10	64	8	17	8	290+	53
44	80	64	10	56	8	17	7	290+	52
45	80	64	10	48	8	17	6	290+	53
43	80	56	10	56	7	17	7	290+	53
53	80	56	10	48	7	17	6	290+	53
51	64	80	8	64	10	17	8	290+	53
44	64	80	8	56	10	17	7	290+	53

TO REMOVE SOFT SOLDER FROM GOLD.—Place the work in spirits of salts, or remove as much as possible with the scraper, using a gentle heat to enable you to get off the solder more easily. Very useful to be known where hard soldering is required, either in bright or colored work.

Trains, for Third Wheel and Patent Seconds.

No. of Teeth in the Centre Wheel	Teeth in 3d Wheel	Leaves in 3d Wheel Pinion.	Teeth in 4th Wheel	Leaves in 4th Wheel Pinion.	Teeth in the Escape-ment Wheel.	Leaves in the Escape-ment Wheel Pinion.	No. of Beats in one Minute.	No. of seconds the 4th Wheel revolves in.
60	72	6	60	12	..	6	300	60
60	60	6	60	10	..	6	300	60
60	48	6	60	8	..	6	300	60
48	60	6	60	8	..	6	300	60
60	72	6	54	12	..	6	270	60
60	60	6	54	10	..	6	270	60
48	60	6	54	8	..	6	270	60
60	72	6	48	12	..	6	240	60
60	60	6	48	10	..	6	240	60
48	60	6	48	8	..	6	240	60

**Trains, for Fourth Wheel Seconds, with Eleven Teeth
in the Escapement Wheel.**

48	40	0	71	6	11	2	250+	60
48	45	6	74	6	11	6	271+	60
48	45	6	76	6	11	6	279-	60
48	45	6	78	6	11	6	286	60
60	49	7	74	7	11	6	271+	60
60	49	7	76	7	11	6	279-	60
60	49	7	78	7	11	6	286	60
45	56	6	74	7	11	6	271+	60
45	56	6	76	7	11	6	279-	60
45	56	6	78	7	11	6	286	60
64	60	8	74	8	11	6	271+	60
64	60	8	76	8	11	6	279-	60
64	60	8	78	8	11	6	286	60
60	56	8	74	7	11	6	271+	60
60	56	8	76	7	11	6	279-	60
60	56	8	78	7	11	6	286	60
60	48	8	74	6	11	6	271+	60
48	48	8	78	8	11	6	286	60
48	60	6	74	8	11	6	271+	60
48	60	6	78	8	11	6	286	60
56	60	7	74	8	11	6	271+	60

Trains, for Fourth Wheel Seconds, with Thirteen Teeth in the Escapement Wheel.

64	60	8	66	8	13	6	286	00
64	60	8	67	8	13	6	290+	60
64	60	8	68	8	13	6	295-	60
64	60	8	69	8	13	6	299	60
60	49	7	77	7	13	7	286	00
60	49	7	66	7	12	6	286	60
60	49	7	67	7	13	6	290+	00
48	45	6	66	6	13	6	286	60
48	45	6	67	6	13	6	290+	60
48	45	6	68	6	13	6	294-	60
48	45	6	69	6	13	6	299	60
60	56	8	66	7	13	6	286	60
80	60	10	66	8	13	6	286	60
64	75	8	66	10	13	6	286	60
48	60	6	66	8	13	6	286	60
48	75	6	66	10	13	6	286	60
45	56	6	66	7	13	6	286	60
56	75	7	68	10	12	6	295-	60

NOTE.—
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wheel fol

Trains, for Fourth Wheel Seconds, with Fifteen Teeth in Escapement Wheel.

No. of Teeth in the Centre Wheel.	Teeth in 3d Wheel.	Leaves in 3d Wheel Pinion.	Teeth in 4th Wheel.	Leaves in 4th Wheel Pinion.	Teeth in the Escapement Wheel.	Leaves in the Escapement Wheel Pinion.	No. of Beats in one Minute.	No. of Seconds the 4th Wheel revolves in.
64	65	8	70	8	15	7	300	60
64	60	8	60	8	15	6	300	60
64	45	8	60	6	15	6	300	60
60	58	8	60	7	15	6	300	60
48	60	6	60	8	15	6	300	60
60	70	7	70	7	15	7	300	60
60	49	7	60	7	15	6	300	60
48	49	6	60	6	15	6	300	60
80	45	10	70	8	15	7	300	60
75	60	10	60	8	15	6	300	60
64	64	8	70	10	15	7	300	60
64	75	8	60	10	15	6	300	60
56	75	7	70	10	15	7	300	60
56	75	7	60	10	15	6	300	60
64	75	8	54	8	15	6	270	60
60	60	8	54	7	15	6	270	60
64	56	8	54	6	15	6	270	60
48	45	6	54	8	15	6	270	60
60	60	7	63	7	15	7	270	60
60	49	7	54	7	15	6	270	60
48	49	6	54	6	15	6	270	60
64	45	8	48	8	15	6	240	60
60	60	8	48	7	15	6	240	60
48	50	6	48	8	15	6	240	60
60	60	8	48	6	15	6	240	60
60	45	7	56	7	15	7	240	60
60	49	7	48	7	15	6	240	60
48	45	6	48	6	15	6	240	60
60	56	8	48	7	15	6	240	60

Trains, for Fourth Wheel Seconds, with Seventeen Teeth in Escapement Wheel.

64	60	8	51	8	17	6	289	60
64	60	8	50	8	17	6	283+	50
60	56	8	51	7	17	6	289	60
80	60	10	50	8	17	6	283+	60
75	64	10	50	8	17	6	283+	60
75	56	10	68	7	17	8	289	60
75	68	10	68	8	17	8	289	60
80	75	10	68	10	17	8	289	60

Train of the American Watch Company's Watch.

64	60	8	64	8	15	7	300	60
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NOTE.—By use of the foregoing set of Trains, and the rule for sizes of pinions, on page 114, all difficulty of calculating is obviated; and at one view, in case of the accidental loss of a wheel and pinion, may be known the correct size and count of the pinion, and number of teeth in the wheel lost.

VALUABLE RECEIPTS FOR GOLDSMITHS.—Standard Gold is compounded of 440 grains of fine gold, and 40 grains (Troy weight, to the oz. alloy; therefore, when you judge how much gold a piece of work will take, compound it to the standard weight by the following directions: *Assay Weight.* The weight of gold is a pound, which is divided into 12 ozs. each oz. into 24 carats, each carat into 4 grains, and, lastly, each grain into 4 quarters; then you see the assay quarter-grain, is in reality $1\frac{1}{4}$ grain Troy.

QUANTITY OF STANDARD GOLD TO COMPOUND AN OZ. OF ANY OF THE FOLLOWING ALLOYS CALCULATED TO THE $\frac{1}{4}$ OF A GRAIN, AS FOLLOWS.

Carat.	Dwts.	Grs.	Qrs.		Dwts.	Grs.	Qrs.
1	0	21	9	ALLOY TO BE ADDED.	19	2	2
2	1	19	7		18	4	4
3	2	17	5		17	6	6
4	3	15	3		16	8	8
5	4	13	1		15	10	10
6	5	10	10		14	13	1
7	6	8	8		13	15	3
8	7	8	6		12	17	5
9	8	4	4		11	19	7
10	9	2	2		10	21	9
11	10	0	0		10	0	0
12	10	21	9		9	2	2
13	11	19	7		8	4	4
14	12	17	5		7	6	6
15	13	15	3		6	8	8
16	14	13	1		5	10	10
17	15	10	10		4	13	1
18	16	8	8		3	15	2
19	17	6	6		2	17	5
20	18	4	4		1	19	7
21	19	2	2		0	21	9
22	22	0	0				

STERLING GOLD ALLOY, 78s. PER OZ.—1. Fine gold, 18 dwt., 12 grs., fine silver, 1 dwt., fine copper, 12 grs. 2. *Dry Colored Gold Alloys.* 17 Carat. Fine gold, 15 dwts., fine silver, 1 dwt. 10 grs., fine copper, 4 dwts. 17 grs. 3. *Another,* 18 Carat. Fine gold, 1 oz., fine silver, 4 dwts. 10 grs., fine copper, 2 dwts. 5 grs. 4. *Another,* 18 Carat. Fine gold, 15 dwts., fine silver, 2 dwts. 4 grs., fine copper, 2 dwts. 19 grs. 5. *Another,* 18 Carat. Fine gold, 18 dwts., fine silver, 2 dwts. 18 grs., fine copper, 3 dwts. 18 grs. 6. *Another,* 19 Carat. Fine gold, 1 oz., fine silver, 2 dwts. 6 grs., fine copper, 3 dwts. 12 grs. 7. *Another,* 20 Carat. Fine gold, 1 oz., fine silver, 2 dwts. 4 grs. 8. *Another,* 22 Carat. Fine gold, 18 dwts., fine silver, 12 grs., fine copper, 1 dwt. 3 grs. 9. *Gold solder for the foregoing Alloys.* Take of the alloyed gold you are using, 1 dwt., fine silver, 6 grs. 10. *Alloy for Dry Colored Rings.* Fine gold, 1 oz., fine silver, 4 dwts. 6 grs., fine copper, 4 dwts. 6 grs. 11. *Solder for ditto.* Scrap gold, 2 ozs., fine silver, 3 dwts., fine copper, 3 dwts. 12. *Dry Colored Scrap reduced to 35s. Gold.* Colored scrap, 1 oz. 9 dwts. 12 grs., fine silver, 2 dwts., fine copper, 17 dwts. 12 grs., spelter, 4 dwts.

DRY COLORING FOR THE FOREGOING.—Polish your work well and for every 2 ozs. take saltpetre, 8 ozs., alum, 4 ozs., salt, 4 ozs., melt all together in a black lead pot. stirring with a thin iron bar

when dissolving. Use the fire on a forge and urge it well with the bellows, as you can not make it too hot. Your polished work being well cleaned with soda, soap, and hot water, is dried in box sawdust, is afterwards covered with a thin layer of borax; annealed and boiled out, and again dried in box sawdust, and finally hung on platinum or silver wire. When the "color" in the pot assumes a brown yellow flame, the work is dipped in for two or three seconds, and quenched with hot water diluted with muriatic acid, which removes any "color" that may adhere to the work. This ought to produce the desired color, but if it does not, repeat the process, previously drying the work before re-immersion in the "color." The color-pot must be emptied immediately upon the forge, so that it may be ready for future use.

WET COLORED ALLOYS.—1. Fine gold, 1 oz., fine silver, 3 dwts. 12 grs., fine copper, 9 dwts. 2. Fine gold, 1 oz., fine silver, 4 dwts. 12 grs., fine copper, 10 dwts. 3. Fine gold, 1 oz., fine silver, 4 dwts. 12 grs., fine copper, 10 dwts. 12 grs. 4. Fine Gold, 1 oz., fine silver, 4 dwts., fine copper, 9 dwts. 12 grs. 5. *Green Gold for Fancy Work.* Fine gold, 1 oz., fine silver, 6 dwts. 16 grs. 6. *Another Green Gold.* Fine gold, 5 dwts., fine silver, 1 dwt. 12 grs. 7. *Another Green Gold.* Fine gold, 10 dwts., fine silver, 2 dwts. 2 grs. 8. *Red Gold, far fancy work.* Fine gold, 5 dwts., fine copper, 2 dwts. 12 grs. 9. *Another Red Gold.* Fine gold, 5 dwts., fine copper, 1 dwt. 6 grs. 10. *Gold solders for the foregoing Alloys.* Take of the alloyed gold you are using 1 dwt., fine silver, 6 grs., or, 5 grs. silver and 1 gr. copper may be used. 11. *Solder for Repairing.* Gold alloyed, 1 dwt., fine silver, 5 grs., pin brass, 1 gr. 12. *Wet Colored Solder.* Wet colored scrap, 3 ozs., fine silver, 10 dwts., fine copper, 5 dwts. 13. *Gold, 15 carat, cost 56s. or \$14 per oz.* Fine gold, 1 oz. 18 dwts., fine silver, 12 dwts. 12 grs., fine copper, 10 dwts. 14. Fine gold, 1 oz., fine silver, 8 dwts. fine copper, 4 dwts. 15. Fine gold, 1 oz., fine silver, 3 dwts., fine copper, 4 dwts. 16. *Gold solder for the last.* Gold scrap, 1 oz., fine silver, 5 dwts. 17. *Gold, good color.* Fine gold, 1 oz., fine silver, 6 dwts., fine copper, 4 dwts. 18. *Gold cost 60s. or \$15, good color.* Fine gold, 1 dwt. fine silver, 6 dwts., fine copper, 4 dwts. 19. *Wet colored solder.* Scrap gold, 4 ozs., fine silver, 13 dwts., fine copper, 6 dwts. 16 grs. 20. *To reduce 22 carat into Wet colored Gold.* Gold coins, 4 ozs., 8 dwts., fine silver, 12 dwts., fine copper, 1 oz. 13 dwts. 21. *To reduce 22 carat to ordinary wet colored Gold with scrap.* Coins 1 oz., fine gold, 3 ozs., fine silver, 17 dwts. 12 grs., fine copper, 2 ozs. 1 dwt. 12 grains., scrap, 3 ozs. 1 dwt. 22. *Another way, with scrap.* Coins, 3 ozs. 1 dwt. 6 grs., fine gold, 2 ozs., fine silver, 1 oz. 1 dwt., fine copper, 2 ozs. 11 dwts., scrap, 1 oz. 6 dwts. 18 grs. 23. *Another way with scrap.* Coins, 2 ozs., fine gold, 3 ozs. 3 dwts. 3 grs., fine silver, 1 oz. 1 dwt. 4 grs., fine copper, 2 ozs. 10 dwts. 12 grs., scrap, 1 oz. 5 dwts. 24. *To reduce 22 carat to ordinary wet colored Gold, without scrap.* Coins, 1 oz., fine gold, 8 ozs., fine silver, 2 ozs., fine copper, 4 ozs. 14 dwts. 25. *Another way, without scrap.* Coins, 1 oz., fine gold, 2 ozs., fine silver, 13 dwts., fine copper, 1 oz., 11 dwts. 26. *Another way, without scrap.* Coins, 2 ozs., fine gold, 6 ozs., fine silver, 1 oz. 14 dwts., fine copper, 4 ozs. 2 dwts.

TO WET-COLOR THE FOREGOING ALLOYS.—For 5 ozs. of work take saltpetre, 16 ozs., alum, 8 ozs., salt, 8 ozs., all pulverized and muriatic acid, 2 ozs., dissolve the ingredients gradually in a black lead pot. When it boils up, add the acid, and stir the whole with a wooden spoon. Having annealed your work and made it perfectly clean, tie in small parcels with platinum or fine silver wire, and when the color boils up immerse it therein for four minutes, moving it about to ensure a perfect contact with all parts of the surface. Then take it out and rinse it well in boiling water, then immerse in the color again for 1½ minutes and rinse well once more in fresh hot water. Now add 2 ozs. of fresh hot water to the color in the pot, which will cause it to sink. When it rises put in your work for 1 minute, rinsing in fresh hot water again, when it will begin to brighten. Now immerse your work for half a minute longer, and rinse for the last time in clean hot water, when it will appear of a most beautiful color.

ORDINARY WET COLORED GOLD.—TABLE SHOWING THE PROPORTIONS OF ALLOY WITH FROM ONE OZ. UP TO TEN OZ. OF FINE GOLD.

Fine Gold.			Fine Silver.			Fine Copper.			Total.		
Oz.	Dwts.	Grs.	Oz.	Dwts.	Grs.	Oz.	Dwts.	Grs.	Oz.	Dwts.	Grs.
1	0	0	0	4	12	0	10	12	1	15	0
2	0	0	0	9	0	1	1	0	3	10	0
3	0	0	0	13	12	1	11	12	5	5	0
4	0	0	0	18	0	2	2	0	7	0	0
5	0	0	1	2	12	2	12	12	8	15	0
6	0	0	1	7	0	3	3	0	10	10	0
7	0	0	1	11	12	3	13	12	12	5	0
8	0	0	1	16	0	4	4	0	14	0	0
9	0	0	2	0	12	4	11	12	15	15	0
10	0	0	2	5	0	5	5	0	17	10	0

ORDINARY BRIGHT GOLD, TABLE SHOWING THE PROPORTION OF ALLOY, WITH FROM 1 OZ. UP TO 6 OZ. OF FINE GOLD.

Fine Gold.			Fine Silver.			Composition.			Total.		
Oz.	Dwts.	Grs.	Oz.	Dwts.	Grs.	Oz.	Dwts.	Grs.	Oz.	Dwts.	Grs.
1	0	0	0	5	0	1	0	0	2	13	0
2	0	0	0	10	0	2	16	0	5	6	0
3	0	0	0	15	0	4	4	0	7	19	0
4	0	0	1	0	0	5	12	0	10	12	0
5	0	0	1	5	0	7	0	0	13	5	0
6	0	0	1	10	0	8	5	0	15	18	0

COMPOSITION FOR THE ABOVE.—Fine Copper 44 ozs. spelter 8 ozs.

TABLE OF ALLOYS FOR DIFFERENT QUALITIES OF GOLD.

Quality.	Fine Gold.			Composition.			Total.		
	Oz.	Dwts.	Grs.	Oz.	Dwts.	Grs.	Oz.	Dwts.	Grs.
9 Carats.	0	7	12	0	12	12	1	0	0
12 "	0	10	0	0	10	0	1	0	0
15 "	0	12	12	0	7	12	1	0	0
18 "	0	15	0	0	5	0	1	0	0
22 "	0	18	18	0	1	6	1	0	0

COMPOSITION FOR THE ABOVE.—Fine Silver, 3 ozs. 5 dwts. 12 grs.
fine copper 8 oz. 12 dwts. 12 grs. Spelter 1 oz. 13 dwts. 6 grs.

ALLOYS, CONTINUED. 1. *Pale gold for coloring, Enamelling, or Lipping*—Fine Gold 1 oz., fine silver 9 dwts., fine copper 2 dwts., 12 grs. 2. *Another ditto*—Fine gold 1 oz., fine silver 9 dwts., fine copper 3 dwts., 12 grs. 3. *Another ditto*—Fine gold 1 oz., fine silver 10 dwts., fine copper 3 dwts., 12 grs. 4. *Enamelling Gold No. 1*—Fine gold 1 oz., fine silver 1 dwt., 13 grs., fine copper 2 dwts., 12 grs. 5. *Enamelling Gold from Sterling*—Sterling 1 oz., fine silver 8 grs., fine copper 2 dwts. 6. *Enamelling Gold Solder*—Gold alloyed, 1 dwt., fine silver 4 grs. 7. *Another ditto, cost 43s. stg., or \$10.75 per oz.*—Fine gold 12 dwts., fine silver 7 dwts., 3 grs., fine copper 6 dwts. 8. *Enamelling Gold No. 2. cost 50s. stg. per oz.*—Fine gold 1 oz., fine silver 9 dwts., 12 grs., fine copper 7 dwts., 12 grs. 9. *Enamelling Gold No. 3*—Fine gold 1 oz., fine silver 14 dwts., fine copper 8 dwts. 10. *Enamelling Gold No. 4*—Fine gold 2 ozs., 5 dwts., fine silver 1 oz., 6 dwts., fine copper 1 oz., pin brass 5 dwts. 11. *Enamelling Gold No. 5*—Fine gold 1 oz., fine silver 12 dwts., fine copper 6 dwts. 12. *Enamelling Gold No. 6. for transparent enamelling*—Fine gold 1 oz., fine silver 14 dwts., fine copper 6 dwts. 13. *Gold solder for enamelled work*—Fine gold 1 oz., fine silver 1 oz., fine copper 10 dwts., silver solder 8 dwts., 8 grs. 14. *Pale Gold alloys for polishing, &c., No. 1*—Fine gold 1 oz., fine silver 8 dwts., fine copper 3 dwts., 12 grs. 15. *Another, No. 2*—Fine gold 1 oz., fine silver 1 dwt., 20 grs., fine copper 1 dwt., 4 grs. 16. *Pale 18 Carat Gold*—Fine gold 1 oz., fine silver 4 dwts., fine copper 2 dwts., 15 grs. 17. *Another Pale 18 Carat Gold*—Fine gold 1 oz., 12 grs., fine silver 3 dwts., 8 grs., fine copper 3 dwts., 8 grs. 18. *Pale Gold Solder*—Gold alloyed 1 dwt., 6 grs., fine silver 1 dwt. 19. *Alloy for best Pens*—Fine gold 1 oz., fine silver 5 dwts., fine copper 7 dwts., 18 grs., spelter 1 dwt., 6 grs. 20. *Solder for ditto*—Fine gold 12 dwts., fine silver 7 dwts., 3 grs., fine copper 6 dwts. 21. *Medium quality pens*—Fine gold 1 oz., Composition 1 oz., 13 dwts. 22. *Composition for the last*—Fine silver 1 oz., 17 dwts., fine copper 5 ozs., 15 dwts., spelter 18 dwts., 20 grs. 23. *Solder for ditto*—Fine gold 1 oz., fine silver 2 ozs., pin-brass 1 oz. 24. *Gold for common pens*—Fine gold 1 oz., fine silver 2 ozs., fine copper 1 oz. 25. *Solder for ditto*—Fine gold 1 oz., fine silver 2 ozs., pin brass 1 oz. 26. *Alloys of Gold with Brass, No. 1*—Fine gold 1 oz., fine silver 5 dwts., 6 grs., fine copper 3 dwts., 12 grs., pin brass 18 dwts. 27. *Another ditto, No. 2*—Fine gold 1 oz., fine silver 4 dwts., fine copper 4 dwts., pin brass 16 dwts. 28. *Another ditto, No. 3*—Fine gold 1 oz., fine silver 5 dwts., 12 grs., fine copper 3 dwts., 12 grs., pin brass 19 dwts., 6 grs. 29. *Another alloy*—Fine gold 1 oz., fine silver 3 dwts., 21 grs., fine copper 9 dwts., 3 grs. composition 5 dwts. 6 grs. 30. *Another ditto*—Fine gold 15 dwts., 9 grs., fine silver 5 dwts., 19 grs. fine copper 3 dwts., 21 grs. composition 15 dwts. 31. *Composition for the last two alloys*—Finest copper 1 oz., spelter 5 dwts. 32. *Solder for foregoing alloys*—Gold alloyed 1 dwt., fine silver 12 grs. 33. *Imitation Gold costs 87c per oz.*—Fine silver 2 ozs., 5 dwts., fine copper 1 oz. composition 1 oz., keeps its color very well. 34. *Composition for ditto*—Fine copper 11 ozs., spelter 2 ozs. 35. *"California" Gold*—Fine gold 5 ozs., 12 dwts. compo-

sition 7 ozs., 17 dwts. 36. *Composition for "California"*—Fine silver 7 ozs., 17 dwts. fine copper 33 ozs. 12 dwts., spelter 5 ozs., 12 dwts. 37. *Medium Gold*—Fine gold 1 oz., fine silver 12 dwts. fine copper 13 dwts. 38. *Bright Gold*—Fine gold 1 oz., fine silver 7 dwts. composition marked No. 34, 1 dwt. 6 grs. 39. *Common Gold, No. 1*—Fine gold 1 oz., fine silver 8 dwts. composition No. 34, 1 oz., 12 dwts. 41. *Common Gold, No. 2*—Fine gold 5 dwts. fine silver 3 dwts. 6 grs. fine copper 6 dwts. 12 grs. 42. *Gold for Pins*—Fine gold 1 oz., fine silver 5 dwts. fine copper 1 oz., spelter 5 dwts. 43. *Dry Colored Scrap reduced to 35s. or \$8.75 Gold*—Colored scrap 1 oz., 9 dwts., 12 grs., fine silver 2 dwts., fine copper 17 dwts. 12 grs., spelter 4 dwts. 44. *Alloy for Gold Chains*—Fine gold 11 dwts., 6 grs., fine silver 2 dwts., 5 grs., fine copper 6 dwts., 12 grs. 45. *Another ditto*—Fine gold 1 oz., fine silver 9 dwts., fine copper 8 dwts. 46. *Gold worth 45s. stg. or \$11.25*—Fine gold 1 oz., composition (see No. 22) 1 oz. 47. *Solder for ditto*—Fine gold 1 oz., fine silver 15 dwts., fine copper 15 dwts. 48. *12 Carat Gold*—Fine gold 1 oz., fine silver 10 dwts., fine copper 9 dwts., 6 grs. 49. *Common Gold from "California"*—"California," (see No. 35.) 8 ozs. fine silver 13 ozs., 16 dwts, fine copper 6 ozs., 16 dwts. 50. *29s. or \$7.25 Gold*—Fine gold 1 oz., 13 dwts., 6 grs., fine silver 1 oz., 12 dwts., 12 grs., fine copper 1 oz., 16 dwts., 6 grs., spelter 4 dwts. Stands nitric acid very well.

CADIZARY BRIGHT GOLD WIRE, TABLE SHOWING THE PROPORTIONS OF ALLOY FROM 1 OZ. UP TO 21 OZ.

Fine Gold.			Fine Silver.			Fine Copper.			Total.		
Oz.	Dwts.	Grs.	Oz.	Dwts.	Grs.	Oz.	Dwts.	Grs.	Oz.	Dwts.	Grs.
0	5	21	0	6	6	0	6	21	1	0	0
0	11	18	0	14	12	0	13	18	2	0	0
0	17	15	1	1	18	1	0	15	3	0	0
1	15	6	2	3	12	2	1	6	6	0	0
2	12	21	3	5	6	2	1	21	9	0	0
3	10	12	4	7	0	4	2	12	12	0	0
4	8	3	5	8	18	5	3	3	15	0	0
5	4	18	6	10	12	6	3	18	18	0	0
6	3	8	7	12	6	2	4	9	21	0	0

TO RECOVER THE GOLD LOST IN COLORING.—Dissolve a handful of sulphate of iron in boiling water, then add this to your "color" water; it precipitates the small particles of gold. Now draw off the water, being very careful not to disturb the auriferous sediment at the bottom. You will now proceed to wash the sediment from all trace of acid with plenty of boiling water; it will require 3 or 4 separate washings, with sufficient time between each to allow the water to cool and the sediment to settle, before pouring the water off. Then dry in an iron vessel by the fire and finally fuse in a covered skittle pot with a flux as directed on page 244. See "*To Fuse Gold Dust.*" For *Silversmiths Compositions*. See page 281

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PRACTICAL METHOD OF PRODUCING ISOCHRONISM IN FLAT AND BREGUET SPRINGS.—*Isochronism*, from the Greek, meaning *equal time*, is the property possessed by the Pendulum and the Hair Spring to accomplish their arcs of vibration of different amplitudes in the same space of time. In a pendulum, the only condition required is that its length be such as to make the centre of gravity move according to the cycloid curve; but in the Hair Spring the means change with the forms affected by the Spring. In the spherical or conical springs, the extreme curves constructed after the mathematical rules discovered by Prof. Phillips, of the Polytechnical School of Paris, will produce an Isochronism very nearly perfect. In the flat spring, these curves cannot exist, therefore other means must be resorted to. I shall give now the results of several years of experiment and study, which can be embodied in the two following theorems:

1.—*In the flat spring, every coil has theoretically a point where the vibrations are Isochronal.*

2.—*That point of Isochronism is determined by the relative position of the two points connecting the hair spring with the collet and stud, called Points d'attache.*

These two propositions form the base of Isochronism in the flat spring; therefore the idea generally accredited among watchmakers that the Isochronal properties of a flat spring depend on its length is incorrect, since the 10th as well as the 20th coil of the spring is able to produce the Isochronism, the only limit being such sizes of springs that would prevent the perfect freedom of its action.

Freedom of action being necessary for the Isochronal properties of the spring to develop themselves, the spring must be bent to the centre, according to Fig. 11—the first coil being too near or the curve too flat, so that even a minute part of the spring could touch the collet, would hinder the Isochronism. Next, the spring must be pinned perfectly tight in the collet and stud, and move freely between the regulator pins.

These conditions fulfilled, the watch is run 3, 6 or 12 hours with just strength enough to keep it going; the result is compared with a regulator and set down. Next, the watch is fully wound up, and after a space of time equal to the first trial, the result is again set down. Most generally the watch will run slower in the short vibrations than in the wide ones, and consequently lose time in the pocket in the last twelve hours of its running. Having set down as a principle that every coil has an Isochronal point, we have now to determine that point, remembering that as a general rule, every increase of length of the spring over that point, will cause the watch to gain in the short vibrations, and every decrease back of that point will cause it to gain in the wide vibrations. This rule is correct only for certain limits, as I am going to explain. Supposing that a Hair Spring of 15 coils is perfectly Isochronal with the two points d'attache just opposite each other, as shown in Fig. 111, the 14th and the 16th coil, as well as the 15th, will produce the Isochronism very nearly at the same point. Supposing that we increase gradually the length of that Hair Spring of 15 coils, pinned up so that the two points d'attache are primitively opposite each other—so that its length will now be 15½ coils—the two points d'attache are now in the position shown in Fig. IV, or what is called pinned to the half coil. The result will be that the Hair Spring will cause the watch to gain in the short vibrations as much as it is in its power to do.

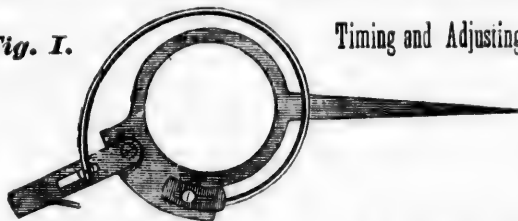
But if we go further than the half coil, we now enter the ground that belongs to the 16th coil, and every increase of length in that half coil will cause the Hair Spring to lose in the short vibrations, in the same proportion that it has been gaining in increasing the length of the first half. That change will continue until we reach the same point on the 16th coil that we started from on the 15th, viz., the two pins opposite each other; at that point we shall have again the Isochronism. The same operation is applicable to the 14th coil, with the same results.

Now it is immaterial whether we take that half coil to the centre, or to the outside of the spring, because both of these operations will produce the same results, viz., the change of the relative places of the points d'attache of the spring. Therefore the artist has his choice, and is guided by the size of the spring and the weight of the balance; for taking half a coil to the centre of the spring will not much affect the rate of the watch, but taken outside, the difference will be great. On

the other hand, a very short cut to the centre will greatly affect the Isochronism, and at the outside, a full half-coil will generally produce from 15 to 25" difference in 24 hours. If then the watchmaker would produce the greatest possible changes of Isochronism in a watch, the change of position of the two *points d'attache* of the spring of one coil around, will give him the two highest degrees of gaining and losing in the short vibrations.

It follows from the following pages, that if a watch loses in the last running (short vibrations), the first thing to do is to increase the length of the Hair Spring from the outside; if the result is better, but not yet good, give still more length; if the result is worse, it shows that you are too far on the coil. Take back the whole length that you had given in the first operation, and draw more length, so as to affect the spring the other way; or if your spring is already small or your balance pretty heavy, cut to the center so as to come around to the required positions.

Fig. I.



Timing and Adjusting.

Fig. II.

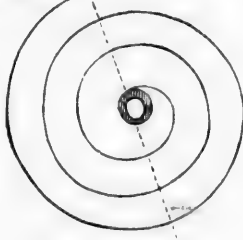


Fig. III.

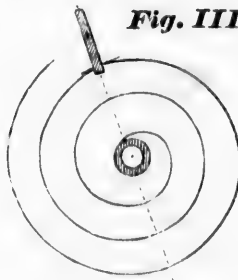


Fig. V.

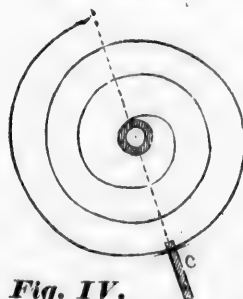
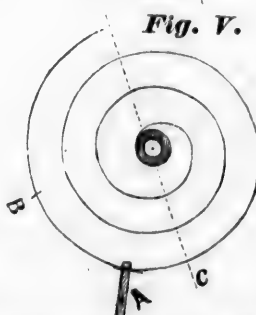


Fig. IV.



For instance, in Fig. V, the spring being pinned in A, and the watch losing 7" in the last 12 hours (short vib.), I first increase the length of the Hair Spring to the point B, but as I am already on the ground belonging to the *losing* action, the result will be an increased loss of time in the last running. I then go back to the point A, and moreover pin the spring to C, and then I shall approximate Isochronism. However, in most cases the increase of length will make the watch gain in its last running.

Some springs cannot produce the Isochronism; this comes from a defect in making the spring, or a want of homogeneity in the metal; the only remedy is a new spring.

In the Breguet Springings, the Isochronism is produced in the same manner as the flat springings, but great care must be taken in making the curve, for if it is not made in conformity to the principle of Philipps, the Isochronism will be disturbed.

ADJUSTMENTS TO POSITIONS.—This adjustment is known to but few watchmakers, and they make it a regular business. It requires of the operator considerable manual skill and reflective powers. The great principle is to equalize the frictions, so that the pivots will offer to the action of the spring the same resistance in the four positions generally required, viz., dial up, XII up, cock up and III up. After having inspected and corrected the train so that the motive power is transmitted uniformly to the balance, the pivots and jewels of the lever should be polished and shortened so as to have very little friction; next, the lever should be poised as nearly perfect as possible, and the slot also in the fork where the ruby pin acts should be polished. The balance jewels ought to be made short enough to have the holes square, rounded inside, and perfectly polished, the balance pivots well burnished and their ends half rounded, and the balance poised very carefully. The English method of throwing the balance out of poise to obtain the same rate in different positions is not accepted generally, and is considered a bad practice by the most eminent watchmakers. The Hair Spring is put in its position without the balance, and bent so that the collet and the cock jewel will have the same centers. The watch being now in good running order, is put under trial for 12 or 24 hours, and the rate in each position carefully noted. If there is any difference in the running with the cock up, or dial up; making the ends of the pivots even and equally well polished will remove the discrepancy. If the watch loses with XII up, which is generally the case, and the friction on the balance jewels being reduced as much as possible, the remedy is to increase the friction when the watch is either dial or cock up. This is done by *throwing the Hair Spring a little out of the center of the cock jewel*, thereby adding to the friction on the pivot end, a lateral pressure against the balance jewels. If the watch is well regulated with XII up, and loses with III up, *throw the spring a little towards the figure III*; this operation lifts up the balance when the watch is in the losing position, and diminishes the friction of the pivots in that particular case. Making the ends of the pivots perfectly flat has a tendency to make the watch gain with dial or cock up. The sound of the watch must be clear in all positions, else it indicates a friction, as for instance rough jewels or pivots, safety pin rubbing against the roller, etc.

HOW TO REGULATE A WATCH IN A FEW MINUTES, AND A PRACTICAL METHOD TO PUT A NEW HAIR SPRING, OF THE RIGHT SIZE AND PERFECTLY REGULATED, IN A WATCH WITHOUT RUNNING IT.
—FIRST, ascertain how many vibrations the watch beats in one minute, by counting every other vibration and comparing that time with a well-regulated watch or regulator. In general, Swiss watches beat 18,000 in one hour, viz., 300 in one minute; American watches, either 18,000, either 16,200, or 270 per minute; and the English levers, 14,400, or 240 per minute. If there is any doubt, it is better to count up leaves and teeth, and ascertain the right number; but these cases are scarce where watches will beat odd numbers.

Having found out the right number, examine the Balance carefully for one or two minutes, counting every vibration going from right to left, and in the mean time examining the regulator or clock, to see when one minute is up. If the watch is well regulated, the number of vibrations must be exactly half of the regular first number, viz., 150, 135, or 120, as only every other vibration has been recorded to facilitate the observation. If not so, move the regulator, right or left, until a perfect coincidence comes.

To pick up a new Hair Spring, after having recorded the right number of beats—either by the old hair spring, or by the numbers of the train—lay first the spring with its center well in the center of the cock jewel, and having ascertained where the coil will enter between the pins of

the regulator, note the place. Stick to the pivot of the balance a small round piece of beeswax; then stick it to the center of the spring, so as to establish a temporary but firm connection of the two pieces, and having pinched with the tweezers the Hair Spring to the place indicated by the regulator pins, cause it to vibrate gently; then count up the vibrations for one minute, and when you have got a spring that will produce nearly the required number of beats, pin it to the collet, and cause it again to vibrate, moving the tweezers forward and backward, until the right number of beats is produced; with another pair of tweezers, pinch the Hair Spring about one-eighth of an inch back of the regulating point, so as to counterbalance the gain produced by the regulator pins, and bend slightly the wire, which is the place where the Hair Spring must be pinned to the stud. Having then tuned up the spring, proceed to put the regulator to the right place, by using the way indicated in the beginning of this article, and the work is done. Success is certain, when the operation has been carefully performed. The balance must be made to vibrate on some hard and well-polished substance, so as to keep up the vibration to about the standard of regular running. A little practice will soon enable the Watchmaker to change a Hair Spring very quick, and without any trouble whatever.

OF COMPENSATION.—A most accurate way of counterbalancing effects produced on the running of watches by different temperatures, is the Expansion Balance, formed of two concentric rings, one interior, of steel, and one exterior, of brass, joined together by hard soldering or smelting. The general proportion of these two metals is one part of steel, and two of brass. The stronger dilatation of brass, causes the rim of the balance to bend inwardly when the heat, increasing, diminishes the strength of the Hair Spring; the greater contraction bends the rim outwardly when cold comes to increase the rigidity of the spring's coils. Pushing forward or backward the screws of the rim will affect the compensating powers of the balance, by causing their weight to be more active as they come nearer the end of the cut arm. The thinner and higher the rim, the greater the action. A few trials will bring the balance to compensate the effects of temperature from 30° to 100° Fahrenheit. For extreme temperatures another compensation, called *auxiliary*, is used, but only in Ship Chronometers. A soft spring will be less affected by changes of temperature than a hardened one; this affords a way to compensate certain balances, where otherwise new ones would have to be used. A precaution to observe in compensating is to make the screws go freely on the balance, and not screw them too tight, else the action of the rim not being free, a good compensation could not be attained, until the combined actions of dilatation and contraction themselves of the rim have freed the screws.

For watchmakers who would want to compensate a watch without having an Expansion Balance, I give the following process, which I have successfully used: After having cut off the greater part of the regulator's arm, another arm is to be fitted with a screw on the rim of the regulator, so as to revolve freely around that screw as an axis. The pins are put in the same position as on the old arm. A ring, of two parts of brass and one of steel, is then fastened at one end on that movable arm, and the other end is screwed at any convenient place, either on the regulator itself, or on the cock. See Fig. 1. By placing the whole ring on the regulator, the latter may be moved as in any other watch; the ring opening or shutting itself under the changes of temperature, will push backward and forward the regulator pins, and so effect the compensation which is to be regulated by varying either the proportion of brass and steel, or the size of the ring.

To try the running of the watches, a common refrigerator is used to produce the low temperature, and then an apparatus, self-regulating, will produce the high temperature. It is commonly a square box of tin or copper, hermetically closed, under which is a gas burner. A compensating arm of the form of a U, made of brass and steel, is fastened inside the box, and is connected by a string with a lever attached to the key of the burner; and acts so that at the high temperature, say 100° Fah., the gas is nearly shut off, the compensating arm gradually releasing itself, and consequently letting out more gas when the heat diminishes inside the box. Use steel pins to secure spring to collet and stud.

To Tighten. It will be better.

To Temper. It is hard by heat of brass before shaping, heating it to the same as.

To Temper. Your drills, and always one way, attempt to. When you thrust in, it is a matter of eye, but, for me, work best.

To Temper. Than drills, use lead in an inch; red, press, an excellent.

Other. Spring into heating, that you piece of brass, directed, the plate cool enough on the plate of the piece, steel art, treated in.

Another. First instance, the ladder, when broken. The thin temper.

To Temper. Steel art, perished in, made with.

To Temper. Spring, the ten.

TO TIGHTEN A RUBY PIN.—Set the ruby pin in asphaltum varnish. It will become hard in a few minutes, and be much firmer and better than gum shellac, as generally used.

TO TEMPER BRASS, OR TO DRAW ITS TEMPER.—Brass is rendered hard by hammering or rolling; therefore, when you make a thing of brass necessary to be in temper, you must prepare the material before shaping the article. Temper may be drawn from brass by heating it to a cherry red, and then simply plunging it into water, the same as though you were going to temper steel.

TO TEMPER DRILLS.—Select none but the finest and best steel for your drills. In making them, never heat higher than a cherry red, and always hammer till nearly cold. Do all your hammering in one way, for if, after you have flattened your piece out, you attempt to hammer it back to a square or a round, you spoil it. When your drill is in proper shape, heat it to a cherry red, and thrust it into a piece of resin or into quicksilver. Some use a solution of cyanuret potassa and rain-water for tempering their drills, but, for my part, I have always found the resin or quicksilver to work best.

TO TEMPER GRAVERS.—Gravers, and other instruments larger than drills, may be tempered in quicksilver as above; or you may use lead instead of quicksilver. Cut down into the lead, say half an inch; then, having heated your instrument to a light cherry red, press it firmly into the cut. The lead will melt around it, and an excellent temper will be imparted.

OTHER METHODS TO TEMPER CASE SPRINGS.—Having fitted the spring into the case according to your liking, temper it hard by heating and plunging into water. Next polish the small end so that you may be able to see when the color changes; lay it on a piece of copper or brass plate, and hold it over your lamp, with the blaze directly under the largest part of the spring. Watch the polished part of the steel closely, and when you see it turn blue, remove the plate from the lamp, letting all cool gradually together. When cool enough to handle, polish the end of the spring again, place it on the plate, and hold it over the lamp as before. The third bluing of the polished end will leave the spring in proper temper. Any steel article to which you desire to give a spring temper may be treated in the same way.

Another process, said to be good, is to temper the spring as in the first instance; then put it into a small iron ladle, cover it with linseed oil, and hold over a lamp till the oil takes fire. Remove the ladle, but let the oil continue to burn until nearly all consumed, when blow out, re-cover with oil, and hold over the lamp as before. The third burning out of the oil will leave the spring in the right temper.

TO TEMPER CLICKS, RATCHETS, &C.—Clicks, ratchets, or other steel articles requiring a similar degree of hardness, should be tempered in mercurial ointment. The process consists in simply heating to a cherry red and plunging into the ointment. No other mode will combine toughness and hardness to such an extent.

TO DRAW THE TEMPER FROM DELICATE STEEL PIECES WITHOUT SPRINGING THEM.—Place the articles from which you desire to draw the temper into a common iron clock key. Fill around it with

brass or iron filings, and then plug up the open end with a steel, iron, or brass plug, made to fit closely. Take the handle of the key with your pliers and hold its pipe into the blaze of a lamp till near hot, then let it cool gradually. When sufficiently cold to handle, remove the plug, and you will find the article with its temper fully drawn, but in all other respects just as it was before.

You will understand the reason for having the article thus plugged up while passing it through the heating and cooling process, when I tell you that springing always results from the action of changeable currents of atmosphere. The temper may be drawn from cylinders, staffs, pinions, or any other delicate pieces, by this mode with perfect safety.

TO TEMPER STAFFS, CYLINDERS, OR PINIONS, WITHOUT SPRINGING THEM.—Prepare the articles as in the preceding process, using a steel plug. Having heated the key-pipe to a cherry red, plunge it into water; then polish the end of your steel plug, place the key upon a plate of brass or copper, and hold it over your lamp with the blaze immediately under the pipe till the polished part becomes blue. Let cool gradually, then polish again. Blue and cool a second time, and the work will be done.

TO DRAW THE TEMPER FROM PART OF A SMALL STEEL ARTICLE.—Hold the part from which you wish to draw the temper with a pair of tweezers, and with your blow-pipe direct the flame upon them—not the article—till sufficient heat is communicated to the article to produce the desired effect.

TO BLUE SCREWS EVENLY.—Take an old watch barrel and drill as many holes into the head of it as you desire to blue screws at a time. Fill it about one-fourth full of brass or iron filings, put in the head, and then fit a wire, long enough to bend over for a handle, into the arbor holes—head of the barrel upwards. Brighten the heads of your screws, set them point downwards, into the holes already drilled, and expose the bottom of the barrel to your lamp till the screws assume the color you wish.

TO REMOVE BLUING FROM STEEL.—Immerse in a pickle composed of equal parts muriatic acid and elixir vitrol. Rinse in pure water, and dry in tissue paper.

TO MAKE DIAMOND BROACHES.—Make your broaches of brass the size and shape you desire; then, having oiled them slightly, roll their points into fine diamond dust till entirely covered. Hold them then on the face of your anvil, and tap with a light hammer till the grains disappear in the brass. Great caution will be necessary in this operation. Do not tap heavy enough to flatten the broach. Very light blows are all that will be required; the grains will be driven in much sooner than one would imagine. Some roll the broach between two smooth pieces of steel to imbed the diamond dust. It is a very good way, but somewhat more wasteful of the dust. Broaches made on this plan are used for dressing out jewels.

JEWELLING.—In using the broaches, press but lightly into the jewel hole, and turn the broach rapidly with the fingers. For polishing, use a bone or ivory point, lightly coated with the finest diamond dust and oil, and while using it with the one hand, accompany the motion with a slight oscillating motion of the other hand, in which

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the jewel is held. This will ensure a more even polish to the hole, with less liability to press the jewel out of its place in the plate, than if held firm and steady.

TO MAKE POLISHING BROACHES.—These are usually made of ivory, and used with diamond dust, loose, instead of having been driven in. You oil the broach lightly, dip it into the finest diamond dust, and proceed to work it into the jewel the same as you do the brass broach. Unfortunately, too many watchmakers fail to attach sufficient importance to the polishing broach. The sluggish motion of watches now-a-days is more often attributable to rough jewels than to any other cause.

TO MAKE DIAMOND FILES.—Shape your file of brass, and charge with diamond dust, as in case of the mill. Grade the dust in accordance with the coarse or fine character of the file desired.

TO MAKE PIVOT FILES.—Dress up a piece of wood file-fashion, about an inch broad, and glue a piece of fine emery paper upon it. Shape your file then, as you wish it, of the best cast steel, and before tempering pass your emery paper heavily across it several times, diagonally. Temper by heating to a cherry red, and plunging into linsed oil. Old worn pivot files may be dressed over and made new by this process. At first thought one would be led to regard them too slightly cut to work well, but not so. They dress a pivot more rapidly than any other file.

TO MAKE BURNISHERS.—Proceed the same as in making pivot files, with the exception that you are to use fine flour of emery on a slip of oiled brass or copper, instead of the emery paper. Burnishers which have become too smooth may be improved vastly with the flour of emery as above without drawing the temper.

TO PREPARE A BURNISHER FOR POLISHING.—Melt a little bees'-wax on the face of your burnisher. Its effect then on brass or other finer metals, will be equal to the best buff. A small burnisher prepared in this way is the very thing with which to polish up watch wheels. Rest them on a piece of pith while polishing.

TO MAKE A DIAMOND MILL.—Make a brass chuck or wheel, suitable for use on a foot-ladle, with a flat even surface or face of about $1\frac{1}{2}$ or 2 inches in diameter; then place a number of the coarsest pieces of your diamond-dust on different parts of its face, and with a smooth-faced steel hammer drive the pieces of dust all evenly into the brass to nearly or quite level with the surface. Your mill, thus prepared, is now used for making pallet jewels or for grinding stone and glass of any kind. For polishing, use a bone or boxwood chuck or wheel, of similar form to your mill, and coat it lightly with the finest grade of your diamond-dust and oil; with this a beautiful polish may be given to the hardest stone.

TO MAKE DIAMOND DUST.—Place a few small pieces of common or cheap diamond on a block of hard polished steel, in a suitable vessel, and cover it with water to prevent flying or scattering, then place a flat steel punch on each piece separately, and strike the punch with a mallet or hammer, with sufficient force to crush the diamond. When reduced sufficiently fine in this way, the dust may be collected and dried for use; after drying, it may be graduated for different purposes, by mixing it with a little watch oil; when agitated, the finest particles will float near the surface, while

the coarsest pieces will sink at once to the bottom; and thus by decanting the oil in which the dust floats, as many grades of fineness as desired may be obtained. The dust may be separated from the oil by pouring on a piece of smooth clean paper; the paper will absorb the oil, or allow it to filter through, while the dust will remain on the surface; but to prevent waste, the better way is to leave it in the oil, and use it directly therefrom as required, or the oil may be washed out of the dust with alcohol.

TO POLISH STEEL.—Take crocus or oxide of tin and graduate it in the same way as in preparing diamond dust, and apply it to the steel by means of a piece of soft iron or bell metal, made proper form, and prepared with flour of emery, same as for pivot burnishers; use the coarsest of the crocus first, and finish off with the finest. To iron or soft steel a better finish may be given by burnishing than can be imparted by the use of polishing powder of any kind whatever.

TO DETERMINE THE EXACT FOCAL DISTANCE OF SPECTACLE GLASSES.—Place the end of a measure of thirty or forty inches in length against a smooth wall, or other suitable ground, in plain view of some well-defined object a few rods distant, as for instance a building or window on the opposite side of the street. Then place the edge of your lens on the measure, and move it backward or forward until a spectrum is formed, or, in other words, until a clear and distinct outline of the distant object is produced on the ground against which your measure rests. This point will represent sufficiently near, for all practical purposes, the exact focal distance of the lens, and will correspond in inches with the number on all properly marked convex spectacles. For mending fine steel spectacle frames, use the best gold in preference to silver or brass solder.

TO WITHDRAW MAGNETISM FROM STEEL AND QUICKSILVER FROM METALS.—A degree of heat, considerably below a red heat, will expel quicksilver from metals in the form of vapor. To withdraw magnetism from steel, &c., cover the article with the juice of common garlic, and then warm it over a spirit lamp. Do not heat sufficiently to draw the temper or blue the steel.

TO PROTECT STONE OR PASTE SET-RINGS, &C., FROM DAMAGE BY HEAT WHILE MENDING.—Cover the head or set part of the ring, or other article, with a thick coating of dampened plaster of Paris, or simply imbed the same in a piece of green apple or potatoe. This will obviate all danger from heat during the process of mending. A light coat of dampened plaster of Paris will, if properly applied, also protect fine Etruscan Jewellery, &c., from change of color while mending.

TO FROST WATCH PLATES.—Watch plates are frosted by means of fine brass wire scratch brushes fixed in a lathe, and made to revolve at great speed, the end of the wire brushes striking the plate producing a beautiful frosted appearance.

TO PREVENT WATCHES LOSING TIME FROM ACTION OF PENDULUM SPRING.—Pin the pendulum spring into the stud, so that that part, the part of the eye immediately emerging from the collet, and the centre of the collet, are in a line; then you will have the spring pinned in, in equal terms, as it is called by those who are versed

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in the higher branches of springing. Bring the watch to time by adding to or taking from the balance, and poise it; try the watch with the 12 up for 2 hours, then with the 6 up for 2 hours, then lying down for the same time; the trials here described will be sufficient if the watch has seconds; keep the curb pins close so as to allow the spring only a little play; the vibration of the balance should be $1\frac{1}{2}$ turn or $1\frac{1}{2}$ lying.

TO RESTORE WATCH DIALS.—If the dial be painted, clean the figure off with spirits of wine, or anything else that will render the dial perfectly clean; then heat it to a bright red, and plunge it into a strong solution of cyanide of potassium, then wash in soap and water, and dry in box dust. Repeat if not a good color. Indian ink, ground with gum water, will do for the figures.

TO MAKE A WATCH KEEP GOOD TIME WHEN THE CYLINDER EDGES ARE WORN OFF, BY ALTERING THE ESCAPEMENT WITHOUT PUTTING A NEW CYLINDER IN.—Look at the cylinder, and see if there is room, either above or below the old wears, to shift the action of the wheel. If the wheel holes are brass, making one a little deeper, and putting a shallower one on the other side, will perhaps be sufficient. This must be done according as you want your wheel up or down. If the holes are stone, shift your wheel on the pinion by a new collet, or turning away more of the old one, as the case may require. If you raise your wheel see that it works free of plate and top of cylinder, and that the web of wheel clears the top of passage. This last fault may be altered by polishing passage a little wider, if rub be slight. If shifted downwards, see to freedom at bottom of cylinder, &c.

POISING WATCH BALANCE.—This may be done with sufficient accuracy by scraping one arm of the callipers with a file when the balance is set in motion. This will cause the heaviest part to settle downwards with certainty, observing always that the pivots are nicely rounded and formed at the ends. In some cases it becomes necessary to put a balance out of poise, in order to make the watch go equally in various positions. The rule for this is: to make the watch gain, the balance should be heaviest on the lower side when hanging up; to make it lose, the reverse.

CUCKOO CLOCKS.—The sound is produced by a wire acting on a small bellows which is connected with two small pipes, like organ pipes.

TO PRESERVE PINIONS OR BEARINGS FROM CORROSION AND RUST.—In case of the lower centre bearing under the cannon pinion corroding or rusting, when you clean the watch, be particular to take the central wheel off. Clean it thoroughly: if the pivot is scratched, polish it, then make a little hollow in the top hole; put good fresh oil on it, and the pivot will not corrode or rust for two or three years. As to the other pivots in the watch, they should all be thoroughly cleaned, and old oil cleaned out; then if no dust gets in, and no accident happens the watch, it will run for years.

THE GERMAN METHOD OF POLISHING STEEL is performed by the use of crocus on a buff wheel. Nothing can exceed the surpassing beauty imparted to steel or even cast iron by this process.

TO CLEAN A CLOCK.—Take the movement of the clock "to pieces." Brush the wheels and pinions thoroughly with a stiff

coarse brush; also the plates into which the trains work. Clean the pivots well by turning in a piece of cotton cloth held tightly between your thumb and finger. The pivot holes in the plates are generally cleansed by turning a piece of wood into them, but I have always found a strip of cloth or a soft cord drawn tightly through them to act the best. If you use two cords, the first one slightly oiled, and the next dry, to clean the oil out, all the better. Do not use salt or acid to clean your clock—it can do no good, but may do a great deal of harm. Boiling the movement in water, as is the practice of some, is also foolishness.

To BUSH.—The hole through which the great arbors, or winding axles, work, are the only ones that usually require bushing. When they have become too much worn, the great wheel on the axle before named strikes too deeply into the pinions above it, and stops the clock. To remedy this, bushing is necessary, of course. The most common way of doing it is to drive a steel point or punch into the plate just above the axle hole, thus forcing the brass downwards until the hole is reduced to its original size. Another mode is to solder a piece of brass upon the plate in such a position as to hold the axle down to its proper place. If you simply wish your clock to run, and have no ambition to produce a bush that will look workmanlike, about as good a way as any is to fit a piece of hard wood between the post which comes through the top of the plate and the axle. Make it long enough to hold the axle to its proper place, so that the axle will run on the end of the grain. Cut notches where the pivots come through, and secure by wrapping around it and the plate a piece of small wire, or a thread. I have known clocks to run well on this kind of bushing, botchified as it may appear, for ten years.

To REMEDY WORN PINIONS.—Turn the leaves or rollers, so the worn places upon them will be towards the arbor or shaft, and fasten them in that position. If they are “rolling pinions,” and you cannot secure them otherwise, you had better do it with a little soft solder.

To OIL PROPERLY.—Oil only, and very lightly, the pallets of the verge, the steel pin upon which the verge works, and the point where the loop of the verge wire works over the pendulum wire. Use none but the best watch oil. Though you might be working constantly at the clock-repairing business, a bottle costing you but twenty-five cents would last you two years at least. You can buy it at any watch-furnishing establishment.

To MAKE THE CLOCK STRIKE CORRECTLY.—If not very cautious in putting up your clock, you will get some of the striking-train wheels in wrong, and thus produce a derangement in the striking. If this should happen, prize the plates apart on the striking side, slip the pivots of the upper wheels out, and having disconnected them from the train, turn them part around and put them back. If still not right, repeat the experiment. A few efforts at most will get them to working properly.

A DEFECT TO LOOK AFTER.—Always examine the pendulum-wire at the point where the loop of the verge wire works over it. You will generally find a small notch, or at least a rough place worn there. Dress it out perfectly smooth, or your clock will not be

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likely to work well. Small as this defect may seem, it stops a large number of clocks.

FIGURES ON GOLD AND SILVER DIALS.—Hold a small piece of copper over a gas flame for a few minutes till it is coated with soot; clear this off on to a piece of finely ground glass, add fat oil and a small quantity of oil of spike lavender, and grind up; paint with a small camel hair pencil.

GOLD.—To find the number of carats of gold in an object, first weigh the gold and mix with seven times its weight in silver. This alloy is beaten into thin leaves, and nitric acid is added; this dissolves the silver and copper. The remainder (gold) is then fused and weighed; by comparing the first and last weights the number of carats of pure gold is found. This operation is always repeated several times, and if any difference occurs in the result, all is done over again.

JEWELLERS' ALLOYS.—*Eighteen-carat gold for rings.*—Gold coin, 19½ gr.; pure copper, 3 gr.; pure silver, 1½ gr. *Cheap gold, twelve-carat.*—Gold coin, 25 gr.; pure copper, 13½ gr.; pure silver, 7½ gr. *Very cheap four-carat gold.*—Copper, 18 parts; gold, 4 parts; silver, 2 parts. *Imitations of gold.*—1. Platina, 4 dwt.; pure copper, 2½ dwt.; sheet-zinc, 1 dwt.; block-tin, 1½ dwt.; pure lead, 1½ dwt. If this should be found too hard or brittle for practical use, re-melting the composition with a little sal-ammoniac will generally render it malleable as desired. 2. Platina, 2 parts; silver, 1 part; copper, 3 parts. These compositions, when properly prepared, so nearly resemble pure gold that it is very difficult to distinguish them therefrom. A little powdered charcoal, mixed with metals while melting, will be found of service. *Best oroside of gold.*—Pure copper, 4 oz.; sheet-zinc, 1½ oz.; magnesia, ½ oz.; sal-ammonia, ½ oz.; quick-lime, ¾ oz.; cream tartar, ¼ oz. First melt the copper at as low a temperature as it will melt; then add the zinc, and afterwards the other articles, in powder, in the order named. Use a charcoal fire to melt these metals.

BUSHING ALLOY FOR PIVOT-HOLES, &C.—Gold coin, 3 dwt.; silver, 1 dwt. 20 gr.; copper, 3 dwt. 20 gr.; palladium, 1 dwt. The best composition known for the purpose named.

GOLD SOLDER FOR FOURTEEN TO SIXTEEN-CARAT WORK.—Gold coin, 1 dwt.; pure silver, 9 gr.; pure copper, 6 gr.; brass, 3 gr. *Darker solder.*—Gold coin, 1 dwt.; pure copper, 8 gr.; pure silver, 5 gr.; brass, 2 gr.; melt together in charcoal fire.

SOLDERS, FOR GOLD.—Gold, 6 dwts.; silver, 1 dwt. copper, 2 dwts. **SOFT GOLD SOLDER.**—Gold, 4 parts; silver, 1 part; copper, 1 part.

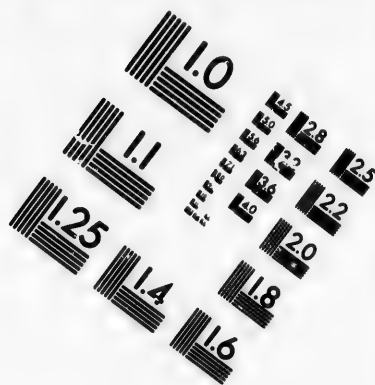
SOLDERS FOR SILVER.—(For the use of jewellers.)—Fine silver, 19 dwts.; copper, 1 dwt.; sheet brass, 10 dwts.

WHITE SOLDER FOR SILVER.—Silver, 1 oz.; tin, 1 oz.

SILVER SOLDER, FOR PLATED METAL.—Fine silver, 1 oz.; brass, 10 dwts.

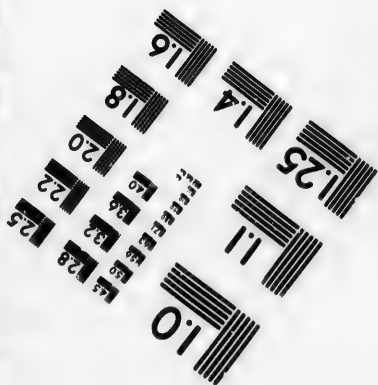
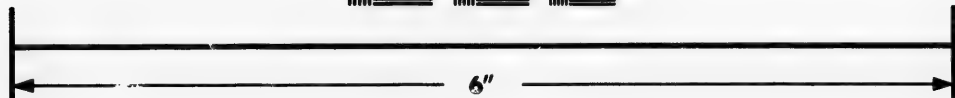
SOLDERS.—For Steel Joints. Silver, 19 parts; copper, 1 part; brass, 2 parts; melt all together. *Hard Solder.*—Copper, 2 parts; zinc, 1 part; melt together. *For Gold.*—1. Silver, 7 parts; copper, 1 part, with borax. 2. Gold, 2 parts; silver, 1 part; copper, 1 part. 3. Gold, 3 parts; silver, 3 parts; copper, 1 part; zinc, 1





Resolution Test Chart Labels:

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- 1.4
- 1.6
- 1.8
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- 2.2
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- 2.8
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(716) 872-4503**

part. *For Silver*.—Silver, 2 parts; brass, 1 part, with borax; or, silver, 4 parts; brass, 3 parts; zinc, $\frac{1}{2}$ part, with borax. *For Brass*.—Copper, 3 parts; zinc, 1 part, with borax. *For Platina*.—Gold, with borax. *For Iron*.—The best solder for iron is good tough brass, with a little borax. *For Copper*.—Brass, 6 parts; zinc, 1 part; tin, 1 part; melt all together, mix well, and pour out to cool.

COLD SOLDERS.—1. Copper, 24.24 parts; silver, 27.57 parts; gold, 48.19 parts. 2. *Enamel Solder*.—Copper, 25 parts; silver, 7.07 parts; gold, 67.93 parts. 3. Copper, 26.25 parts; zinc, 6.25 parts; silver, 31.25 parts; gold, 36.25 parts. 4. *Enamel Solder*.—Silver, 19.57 parts; gold, 80.43 parts.

SOLDER.—*For 22 carat gold*.—Gold of 22 carats, 1 dwt.; silver, 2 gr.; copper, 1 gr. *For 18 carat gold*.—Gold, of 18 carats, 1 dwt.; silver, 2 gr.; copper, 1 gr.

For cheaper gold.—Gold, 1 dwt.; silver, 10 gr.; copper, 8 gr.

Cheaper still.—Fine gold, 1 dwt.; silver, 1 dwt.; copper, 1 dwt.

SILVER SOLDERS.—1. (*hard*.) Copper, 30 parts; zinc, 12.85 parts; silver, 57.15 parts. 2. Copper, 23.33 parts; zinc, 10.00 parts; silver, 66.67 parts. 3. Copper, 26.66 parts; zinc, 10.00 parts; silver, 63.34 parts. 4. (*soft*.) Copper, 14.75 parts; zinc, 8.20 parts; silver, 77.05 parts. 5. Copper, 22.34 parts; zinc, 10.48 parts; silver, 67.18 parts. 6. Tin, 63.00 parts; lead, 37 parts.

COLORING GOLD.—1. *Full red gold*.—Gold, 5 dwt.; copper, 5 dwt. 2. *Red gold*.—Gold, 10 dwt.; silver, 1 dwt.; copper, 4 dwt. 3. *Green Gold*.—Gold, 5 dwt.; silver, 21 gr. 4. *Gray gold*.—Gold, 3 dwt. 15 gr.; silver, 1 dwt. 9 gr. 5. *Blue gold*.—Gold, 5 dwt.; steel filings, 5 dwt. 6. *Antique gold, greenish-yellow color*.—Gold, 18 dwt. 9 gr.; silver, 21 gr.; copper, 18 gr. These all require to be submitted to the process of wet-coloring. 7. *Facitious gold, very bright*.—Copper, 16 parts; platina, 7 parts; zinc, 1 part; fused together.

ALLOYS FOR GOLD.—1. *Red gold*.—Copper, 66.67 parts; gold, 33.33 parts. 2. *Yellow gold*.—Copper, 12.50 parts; silver, 37.50 parts; gold, 50 parts. 3. *Green gold*.—Silver, 25 parts; gold, 75 parts. 4. *Yellow gold*.—Silver, 65.67 parts; gold, 33.33 parts. 5. *Gray gold*.—Silver, 5.89 parts; gold, 88.23 parts; iron, 5.89 parts. 6. *Dentists' gold*.—Silver, 8.34 parts; platinum, 66.67 parts; gold, 24.29 parts. 7. *English gold coin*.—Copper, 8.34 parts; gold, 91.66 parts. *American gold coin*.—Copper, 10 parts; gold, 90 parts. French gold coin same as American.

ALLOYS FOR SILVER COIN AND PLATE.—1. *English standards*.—Copper, 7.50 parts; silver, 92.50 parts. 2. *American ditto*.—Copper, 10 parts; silver, 90 parts. French, the same.

GILDING METAL for common jewellery is made by mixing 4 parts copper with one of calamine brass. Sometimes 1 lb. copper, with 6 oz. of brass.

DENTISTS' PLATE.—No. 1 Gold, 20 dwts.; silver, 1 dwt.; copper, 2 dwts. 2. Gold, 21, silver, 2; copper, 1.

JEWELLERS' SOLDERING FLUID.—Muriatic acid, $\frac{1}{2}$ pt.; grain zinc, 1 $\frac{1}{2}$ oz. Dissolve, and add a little common solder and sal-ammoniac.

GOLD FOR SPRINGS.—Gold, 18 dwts. 12 grs.; silver, 6 dwts.; copper, 5 dwts.

JEWELLERS' GOLD COMPOSITIONS.—*Common Gold:* Silver, 1 part; Spanish copper, 16 parts; gold, 2 parts; mix. *Ring Gold:* Spanish copper, 6 parts; silver, 3 parts; gold, 5 parts; mix. *Manheim Gold:* copper, 3 parts; zinc, 1 part. Melt, and stir well. *Mosaic Gold:* copper and zinc, equal parts; melt at the lowest temperature that will fuse the former, then mix by stirring, and add 5 per cent. more zinc. *Parker's Mosaic Gold:* copper, 100 parts; zinc, 54 parts. *For common Jewellery:* copper, 3 parts; 1 of old brass, and 4 oz. of tin to every lb. of copper.

FACTITIOUS GOLD.—Copper, 16 parts; platinum, 7 parts; zinc, 1 part; fused together. This alloy resembles gold of 16 carats fine, or $\frac{3}{4}$, and will resist the action of nitric acid, unless very concentrated and boiling.

HARMSTADT'S TRUE IMITATION OF GOLD is stated not only to resemble gold in color, but also in specific gravity and ductility. Platinum, 16 parts; copper, 7 parts; zinc, 1 part; put it in a crucible, cover with charcoal powder, and melt into a mass.

DO. OF SILVER.—Copper, $\frac{1}{4}$ oz.; brass, 2 oz.; pure silver, 3 oz.; bismuth, 2 oz.; saltpetre, 2 oz.; common salt, 1 oz.; arsenic, 1 oz.; potash, 1 oz.; melt in a crucible with powdered charcoal. This compound, was by a German chemist for unlawful purposes, was so perfect that he was never discovered.

ARTIFICIAL GOLD.—This is a new metallic alloy which is now very extensively used in France as a substitute for gold. Pure copper, 100 parts; zinc, or, preferably, tin, 17 parts; magnesia, 6 parts; sal-ammoniac, 3-6 parts; quick-lime, $\frac{1}{2}$ part; tartar of commerce, 9 parts; are mixed as follows: The copper is first melted, and the magnesia, sal-ammoniac, lime and tartar are then added separately, and by degrees, in the form of powder; the whole is now briskly stirred for about $\frac{1}{2}$ an hour, so as to mix thoroughly; and then the zinc is added in small grains by throwing it on the surface, and stirring till it is entirely fused: the crucible is then covered, and the fusion maintained for about 35 minutes. The surface is then skimmed, and the alloy is ready for casting. It has a fine grain, is malleable, and takes a splendid polish. It does not corrode readily, and, for many purposes, is an excellent substitute for gold. When tarnished, its brilliancy can be restored by a little acidulated water. If tin be employed instead of zinc, the alloy will be more brilliant. It is very much used in France, and must ultimately attain equal popularity here.

NEW FRENCH PATENT ALLOY FOR SILVER.—Messieurs De Ruolz & Fontenay have invented the following alloy, which may be used for almost all purposes in which silver is usually applied. Silver, 20 parts; purified nickel, 28 parts; copper, 52 parts. Melt the copper and nickel in the granular state, then introduce the silver. The flux to be employed is charcoal and borax, both in the state of powder; and the ingots obtained are to be rendered malleable by annealing for a considerable time in powdered charcoal.

ENGLISH STANDARD FOR SILVER.—Pure silver, 11 oz. 2 dwts.; copper, 22 dwts.: melt.

SILVER IMITATIONS.—Copper, 1 lb.; tin, $\frac{3}{4}$ oz.; melt. This composition will roll and ring very near to silver. *Britannia Metal:* copper, 1 lb.; tin, 1 lb.; regulus of antimony, 2 lbs.; melt toge-

ther, with or without a little bismuth. *Genuine German Silver*: iron, 2½ parts; nickel, 3½ parts; zinc, 25½ parts; copper, 40½ parts; melt. *Fine White German Silver*: iron, 1 part; nickel, 10 parts; zinc, 10 parts; copper, 20 parts; melt. *Pinchbeck*: copper, 5 parts; zinc, 1 part; melt the copper; then add the zinc. *Jewellers' Metal*: copper, 30 parts; tin, 7 parts; brass, 10 parts; mix.

FRENCH GOLD PLATE.—1. Gold, 92 parts; copper, 8 parts. 2. Gold, 84 parts; copper, 16 parts. 3. Gold, 75 parts; copper, 25 parts.

BIDERY.—Copper, 48.48 parts; tin, 6.60 parts; zinc, 33.80 parts; lead, 12.12 parts.

BEST BRASS FOR CLOCKS.—Rose copper, 85 parts; zinc, 14 parts; lead, 1 part.

ALLOY FOR WATCH PINION SOCKETS.—Gold, 31 parts; silver, 10 parts; copper, 39 parts; palladium, 1 part.

PICKLE, FOR FROSTING AND WHITENING SILVER GOODS.—Sulphuric acid, 1 dr.; water, 4 oz.; heat the pickle, and immerse the silver in it until frosted as desired; then wash off clean, and dry with a soft linen cloth, or in fine clean sawdust. For whitening only, a smaller proportion of acid may be used.

ETRUSCAN GOLD COLORING.—Alum, 1 oz.; fine table-salt, 1 oz.; saltpetre (powdered), 2 oz.; hot rain-water, sufficient to make the solution, when dissolved, about the consistency of thick ale; then add sufficient muriatic acid to produce the color desired. The degree of success must always depend, in a greater or less degree, upon the skill or judgment of the operator. The article to be colored should be from fourteen to eighteen carats fine, of pure gold and copper only, and be free from coatings of tin or silver solder. The solution is best used warm, and when freshly made the principle on which it acts is to eat out the copper alloy from the surface of the article, leaving thereon pure, frosted gold only. After coloring, wash off, first in rain-water, then in alcohol, and dry without rubbing, in fine clean sawdust. Fine Etruscan jewellery, that has been defaced or tarnished by use, may be perfectly renewed by the same process.

TARNISH ON ELECTRO-PLATE GOODS may be removed by immersing the article from one to ten or fifteen minutes, or until the tarnish has been removed, but no longer, in the following solution: Rain-water, 2 gals.; cyanuret potassa, ¼ lb.; dissolve, and put into a stone jug or jar and closely cork. After immersion, the articles must be taken out and thoroughly rinsed in two or three waters, then dried with a soft linen cloth, or, if frosted or chased work, with fine clean sawdust. Tarnished jewellery may be speedily restored by this process; but make sure work of removing the alkali, otherwise it will corrode the goods.

A BRIGHT GOLD TINGE may be given to silver by steeping it for a suitable length of time in a weak solution of sulphuric acid and water strongly impregnated with iron-rust.

TO REFINER GOLD.—If you desire to refine your gold from the baser metals, swedge or roll it out very thin, then cut into narrow strips and curl up so as to prevent its lying flatly. Drop the pieces thus prepared into a vessel containing good nitric acid, in the proportion of acid, 2 oz., and pure rain-water, ½ oz. Suffer to remain

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until thoroughly dissolved, which will be the case in from $\frac{1}{2}$ an hour to 1 hour. Then pour off the liquid carefully, and you will find the gold, in the form of a yellow powder, lying at the bottom of the vessel. Wash this with pure water till it ceases to have an acid taste, after which you may melt and cast into any form you choose. Gold treated in this way may be relied on as perfectly pure.

In melting gold use none other than a charcoal fire, and during the process sprinkle saltpetre and potash into the crucible occasionally. Do not attempt to melt with stone coal, as it renders the metal brittle and otherwise imperfect.

TO REFINER SILVER.—Dissolve in nitric acid as in the case of the gold. When the silver has entirely disappeared, add to the $2\frac{1}{2}$ oz. of solution nearly 1 quart of pure rain-water. Sink, then, a sheet of clean copper into it ; the silver will collect rapidly upon the copper, and you can scrape it off and melt into bulk at pleasure.

In the event of your refining gold in accordance with the foregoing formula, and the impurity was silver, the only steps necessary to save the latter would be to add the above named proportion of water to the solution poured from the gold, and then to proceed with your copper plate as just directed.

TO REFINER COPPER.—This process differs from the one employed to refine silver in no respects save the plate to be immersed ; you use an iron instead of a copper plate to collect the metal.

If the impurities of gold refined were both silver and copper, you might, after saving the silver as above directed, sink your iron plate into the solution yet remaining, and take out the copper. The parts of alloyed gold may be separated by these processes, and leave each in a perfectly pure state.

GOLD SILVERING OF METALS.—Mix 1 part of chloride of silver with 3 parts of pearlsh, $1\frac{1}{2}$ parts common salt, and 1 part whitening ; and well rub the mixture on the surface of brass or copper (previously well cleaned), by means of a piece of soft leather, or a cork moistened with water and dipped in the powder. When properly silvered, the metal should be well washed in hot water, slightly alkalinized ; then wiped dry.

TO HEIGHTEN THE COLOR OF YELLOW GOLD.—Saltpetre, 6 oz. ; green copperas, 2 oz. ; white vitriol and alum, of each 1 oz. If wanted redder, a small quantity of blue vitriol must be added.

FOR GREEN GOLD.—Saltpetre, 1 oz. 10 dwts. ; sal-ammoniac, 1 oz. 4 dwts. ; Roman vitriol, 1 oz. 4 dwts. ; verdigris, 18 dwts.

TO CLEAN GILT JEWELLERY.—Boiling water in a clean flask, $\frac{1}{2}$ pt. ; cyanide of potassium, 1 oz. ; shake the flask to dissolve the potassium. Add, when cold, liquor ammonia, $\frac{1}{2}$ oz. ; rectified alcohol, 1 oz. Used by brushing over gilded articles.

COLORING JEWELLERY.—Boil the articles in a dilute solution of terchloride of gold, to which some bicarbonate of soda has been added.

COLORING OF GILDING.—Defective colored gilding may also be improved by the help of the following mixture : nitrate of potash, 3 oz. ; alum, $1\frac{1}{2}$ oz. ; sulphate of zinc, $1\frac{1}{2}$ oz. ; common salt, $1\frac{1}{2}$ oz. These ingredients are to be put into a small quantity of water to form a sort of paste, which is put upon the articles to be colored ; they are then placed upon an iron plate over a clear fire, so that

they will attain nearly to a black heat, when they are suddenly plunged into cold water; this gives them a beautiful high color. Different hues may be had by a variation in the mixture.

FOR RED GOLD.—To 4 oz. melted yellow wax, add, in fine powder, $\frac{1}{2}$ oz. of red ochre; $1\frac{1}{2}$ oz. verdigris, calcined till it yields no fumes; and $\frac{1}{2}$ oz. of calcined borax. Mix them well together. Dissolve either of above mixtures in water, as the color is wanted, and use as required.

GOLD is taken from the surface of silver by spreading over it a paste made of powdered sal-ammoniac, with aquafortis, and heating it till the matter smokes, and it is nearly dry; when the gold may be separated by rubbing it with a scratch brush.

MOULDS AND DIES.—Copper, zinc, and silver in equal proportions; melt together under a coat of powdered charcoal, and mould into the form you desire. Bring them to nearly a white heat, and lay on the thing you would take the impression of, press with sufficient force, and you will get a perfect and beautiful impression.

POLISHING POWDER FOR GOLD AND SILVER.—Rock alum burnt and finely powdered, 5 parts; levigated chalk, 1 part. Mix; apply with a dry brush.

SILVER-PLATING FLUID.—Dissolve 1 ounce of nitrate of silver, in crystals, in 12 ounces of soft water; then dissolve in the water 2 oz. cyanuret of potash; shake the whole together, and let it stand till it becomes clear. Have ready some half-ounce vials, and fill half full of Paris white, or fine whiting; and then fill up the bottles with the liquor, and it is ready for use. The whiting does not increase the coating powder; it only helps to clean the articles, and save the silver fluid, by half filling the bottles.

JEWELLERS' ARMENIAN CEMENT.—Isinglass soaked in water and dissolved in spirit, 2 oz. (thick); dissolve in this 10 grs. of very pale gum ammonia (in tears) by rubbing them together; then add 6 large tears of gum mastic, dissolved in the least possible quantity of rectified spirit. When carefully made, this cement resists moisture and dries colorless. Keep in a closely stopped phial.

JEWELLERS' TURKISH CEMENT.—Put into a bottle 2 oz. of isinglass and 1 oz. of the best gum arabic; cover them with proof spirits, cork loosely, and place the bottle in a vessel of water, and boil it till a thorough solution is effected; then strain for use; best cement known.

REVIVE FOR OLD JEWELLERY.—Dissolve sal-ammoniac in urine and put the jewellery in it for a short time; then take it out, and rub with chamois leather, and it will appear equal to new.

TO RECOVER GOLD FROM GILT METAL.—Take a solution of borax water, apply to the gilt surface, and sprinkle over it some finely powdered sulphur; make the article red hot, and quench it in water; then scrape off the gold, and recover it by means of lead.

TO SEPARATE GOLD AND SILVER FROM LACE, &C.—Cut in pieces the gold or silver lace, tie it tightly, and boil it in soap lye till the size appears diminished; take the cloth out of the liquid, and, after repeated rinsings in cold water, beat it with a mallet to draw out all the alkali. Open the linen, and the pure metal will be found in all its beauty.

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TO HARD SOLDER GOLD, SILVER, COPPER, BRASS, IRON, STEEL OR PLATINA.—The solders to be used for gold, silver, copper and brass are given in the preceding part. You commence operations by reducing your solder to small particles, and mixing it with powdered sal-ammoniac and powdered borax in equal parts, moistened to make it hold together. Having fitted up the joint to be soldered, you secure the article upon a piece of soft charcoal, lay your soldering mixture immediately over the joint, and then with your blow-pipe turn the flame of your lamp upon it until fusion takes place. The job is then done, and ready to be cooled and dressed up.

Iron is usually soldered with copper or brass in accordance with the above process. The best solder for steel is pure gold or pure silver, though gold or silver solders are often used successfully.

Platina can only be soldered well with gold; and the expense of it, therefore, contributes to the hindrance of a general use of platina vessels, even for chemical purposes, where they are of so much importance.

TO SOFT SOLDER ARTICLES.—Moisten the parts to be united with soldering fluid; then, having joined them together, lay a small piece of solder upon the joint and hold over your lamp, or direct the blaze upon it with your blow-pipe until fusion is apparent. Withdraw them from the blaze immediately, as too much heat will render the solder brittle and unsatisfactory. When the parts to be joined can be made to spring or press against each other, it is best to place a thin piece of solder between them before exposing to the lamp.

Where two smooth surfaces are to be soldered one upon the other, you may make an excellent job by moistening them with the fluid, and then, having placed a sheet of tin foil between them, holding them pressed firmly together over your lamp till the foil melts. If the surfaces fit nicely, a joint be may made in this way so close as to be almost imperceptible. The brightest looking lead which comes as a lining to tea boxes works better in the same way than tin foil.

TO CLEANSE GOLD TARNISHED IN SOLDERING.—The old English mode was to expose all parts of the article to a uniform heat, allow it to cool, and then boil until bright in urine and sal-ammoniac. It is now usually cleansed with diluted sulphuric acid. The pickle is made in about the proportion of one-eighth of an ounce acid to one ounce rain-water.

TO CLEANSE SILVER TARNISHED IN SOLDERING.—Some expose to a uniform heat, as in the case of gold, and then boil in strong alum water. Others immerse for a considerable length of time in a liquid made of $\frac{1}{2}$ oz. of cyanuret potassa to 1 pint rain water, and then brush off with prepared chalk.

BEAUTIFUL BRONZE FOR LEATHER.—Dissolve a little of the so-called insoluble aniline violet in a little water, and brush the solution over the leather; after it dries, repeat the process.

NICKEL-PLATING.—The following is the substance of the patent granted to Dr. Isaac Adams, March 22, 1870. The process is highly successful. "This improvement consists in the use of 3 new solutions from which to deposit nickel by the electric current.

1. A solution formed of the double sulphate of nickel and alumina, or the sulphate of nickel dissolved in a solution of soda, potash, or ammonia alum, the three different varieties of commercial alum. 2. A solution formed of the double sulphate of nickel and potash. 3. A solution formed of the double sulphate of nickel and magnesia, with or without an excess of ammonia. I have found that a good coating of nickel can be deposited from the solutions before mentioned, provided they are prepared and used in such a manner as to be free from any acid or alkaline reaction. When these solutions are used, great care must be taken, lest by the use of too high battery power, or from the introduction of some foreign matters, the solution becomes acid or alkaline. I prefer to use these solutions at a temperature above 100° Fah., but do not limit my invention to the use of these solutions at that temperature. I therefore claim, 1. The electro deposition of nickel by means of a solution of the double sulphate of nickel and alumina, prepared and used in such a manner as to be free from the presence of ammonia, potash, soda, lime, or nitric acid, or from any acid or alkaline reaction. 2. The electro deposition of nickel by means of a solution of the double sulphate of nickel and potash, prepared and used in such a manner as to be free from the presence of ammonia, soda, alumina, lime or nitric acid, or from any acid or alkaline reaction. 3. The electro deposition of nickel by means of a solution of the double sulphate of nickel and magnesia, prepared and used in such a manner as to be free from the presence of potash, soda, alumina, lime or nitric acid, or from any acid or alkaline reaction."

TO MAKE SILVER SOLUTION FOR ELECTRO-PLATING.—Put together into a glass vessel 1 oz. good silver, made thin and cut into strips; 2 oz. best nitric acid, and $\frac{1}{2}$ oz. pure rain water. If solution does not begin at once, add a little more water—continue to add a very little at a time till it does. In the event it starts off well, but stops before the silver is fully dissolved, you may generally start it up again all right by adding a little more water.

When solution is entirely effected, add 1 quart of warm rain water and a large tablespoonful of table salt. Shake well and let settle, then proceed to pour off and wash through other waters as in the case of the gold preparation. When no longer acid to the taste, put in an ounce and an eighth cyanuret potassa and a quart pure rain water; after standing about 24 hours, it will be ready for use.

TO MAKE GOLD SOLUTION FOR ELECTRO-PLATING.—Dissolve five pennyweights gold coin, 5 grains pure copper, and 4 grains pure silver in 3 oz. nitro-muriatic acid; which is simply 2 parts muriatic acid and 1 part nitric acid. The silver will not be taken into solution as are the other 2 metals, but will gather at the bottom of the vessel. Add 1 oz. pulverized sulphate of iron, $\frac{1}{2}$ oz. pulverized borax, 25 grains pure table salt, and 1 quart hot rain water. Upon this the gold and copper will be thrown to the bottom of the vessel with the silver. Let stand till fully settled, then pour off the liquid carefully, and refill with boiling rain water as before. Continue to repeat this operation until the precipitate is thoroughly washed; or, in other words, fill up, let settle, and pour off so

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You now have about an 18 carat chloride of gold. Add to it an ounce and an eighth cyanuret potassa, and 1 quart rain water—the latter heated to the boiling point. Shake up well, then let stand about 24 hours, and it will be ready for use.

Some use platina as an alloy instead of silver, under the impression that plating done with it is harder. I have used both, but never could see much difference.

Solution for a darker colored plate to imitate Guinea gold may be made by adding to the above 1 oz. of dragon's blood and 5 grs. iodide of iron.

If you desire an alloyed plate, proceed as first directed, without the silver or copper, and with an ounce and a half of sulphuret potassa in place of the iron, borax, and salt.

To PLATE WITH A BATTERY.—If the plate is to be gold, use the gold solution for electro-plating; if silver, use the silver solution. Prepare the article to be plated by immersing it for several minutes in a strong lye made of potash and rain-water, polishing off thoroughly at the end of the time with a soft brush and prepared chalk. Care should be taken not to let the fingers come in contact with the article while polishing, as that has a tendency to prevent the plate from adhering; it should be held in two or three thicknesses of tissue paper.

Attach the article, when thoroughly cleansed, to the positive pole of your battery, then affix a piece of gold or silver, as the case may be, to the negative pole, and immerse both into the solution in such a way as not to hang in contact with each other.

After the article has been exposed to the action of the battery about ten minutes, take it out and wash or polish over with a thick mixture of water and prepared chalk or jeweller's rouge. If, in the operation, you find places where the plating seems inclined to peel off, or when it has not taken well, mix a little of the plating solution with prepared chalk or rouge, and rub the defective part thoroughly with it. This will be likely to set all right.

Govern your time of exposing the article to the battery by the desired thickness of the plate. During the time, it should be taken out and polished up as just directed about every ten minutes, or as often at least as there is an indication of a growing darkness on any part of its surface. When done, finish with the burnisher on prepared chalk and chamois skin, as best suits your taste and convenience.

In case the article to be plated is iron, steel, lead, pewter, or block tin, you must, after first cleaning with the lye and chalk, prepare it by applying with a soft brush—a camel's hair pencil is best suited—a solution made of the following articles in the proportion named:—Nitric acid, $\frac{1}{2}$ oz.; muriatic acid, $\frac{1}{4}$ oz.; sulphuric acid, 1-9th oz.; muriate of potash, 1-7th oz.; sulphate of iron, $\frac{1}{4}$ oz.; sulphuric ether, 1-5th oz.; and as much sheet zinc as it will dissolve. This prepares a foundation, without which the plate would fail to take well, if at all.

To MAKE GOLD AMALGAM.—Eight parts of gold and one of mercury are formed into an amalgam for plating, by rendering the

gold into thin plates, making it red hot and then putting it into the mercury while the latter is also heated to ebullition. The gold immediately disappears in combination with the mercury, after which the mixture may be turned into water to cool. It is then ready for use.

TO PLATE WITH GOLD AMALGAM.—Gold amalgam is chiefly used as a plating for silver, copper or brass. The article to be plated is washed over with diluted nitric acid or potash lye and prepared chalk, to remove any tarnish or rust that might prevent the amalgam from adhering. After having been polished perfectly bright, the amalgam is applied as evenly as possible, usually with a fine scratch brush. It is then set upon a grate over a charcoal fire, or placed into an oven and heated to that degree at which mercury exhales. The gold, when the mercury has evaporated, presents a dull yellow color. Cover it with a coating of pulverized nitre and alum in equal parts, mixed to a paste with water, and heat again till it is thoroughly melted, then plunge into water. Burnish up with a steel or bloodstone burnisher.

TO MAKE AND APPLY GOLD-PLATING SOLUTION.—Dissolve $\frac{1}{2}$ oz. of gold amalgam in 1 oz. of nitro-muriatic acid. Add 2 oz. of alcohol, and then, having brightened the article in the usual way, apply the solution with a soft brush. Rinse and dry in sawdust, or with tissue paper, and polish up with chamois skin.

TO MAKE AND APPLY GOLD-PLATING POWDERS.—Prepare a chloride of gold the same as for plating with a battery. Add to it, when thoroughly washed out, cyanuret potassa in a proportion of 2 oz. to 5 pennyweights of gold. Pour in a pint of clean rain water, shake up well and then let stand till the chloride is dissolved. Add then 1 lb. of prepared Spanish whiting and let evaporate in the open air till dry, after which put away in a tight vessel for use. To apply it you prepare the article in the usual way, and having made the powder into a paste with water, rub it upon the surface with a piece of chamois skin or cotton flannel.

An old mode of making a gold-plating powder was to dip clean linen rags into solution prepared as in the second article preceding this, and having dried, to fire and burn them into ashes. The ashes formed the powder, and were to be applied as above.

TO MAKE AND APPLY SILVER-PLATING SOLUTION.—Put together in a glass vessel 1 oz. nitrate of silver, 2 oz. cyanuret potassa, 4 oz. prepared Spanish whiting, and 10 oz. pure rain water. Cleanse the article to be plated as per preceding directions, and apply with a soft brush. Finish with the chamois skin or burnisher.

TO MAKE AND APPLY SILVER-PLATING POWDER.—Dissolve silver in nitric acid by the aid of heat; put some pieces of copper into the solution to precipitate the silver; wash the acid out in the usual way; then, with 15 grains of it mix 2 drams of tartar, 2 drams of table salt, and $\frac{1}{2}$ dram of pulverized alum. Brighten the article to be plated with lye and prepared chalk, and rub on the mixture. When it has assumed a white appearance, expose to heat as in the case of plating with gold amalgam, then polish up with the burnisher or soft leather.

TO ENAMEL GOLD OR SILVER.—Take $\frac{3}{4}$ pennyweight of silver, 2 pennyweights of copper, $3\frac{1}{2}$ pennyweights of lead, and 2 penny-

putting it into solution. The gold mercury, after cool. It is then

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ht of silver, $2\frac{1}{2}$ and $2\frac{1}{2}$ penny-

weights of muriate of ammonia. Melt together, and pour into a crucible with twice as much pulverized sulphur; the crucible is then to be immediately covered that the sulphur may not take fire, and the mixture is to be calcined over a smelting fire until the superfluous sulphur is burned away. The compound is then to be coarsely pounded, and, with a solution of muriate of ammonia, to be formed into a paste which is to be placed upon the article it is designed to enamel. The article must then be held over a spirit lamp till the compound upon it melts and flows. After this it may be smoothed and polished up in safety. This makes the black enamel now so much used on jewellery.

TO DESTROY THE EFFECTS OF ACID ON CLOTHES.—Dampen as soon as possible, after exposure to the acid, with spirits ammonia. It will destroy the effect immediately.

TO WASH SILVERWARE.—Never use a particle of soap on your silverware, as it dulls the lustre, giving the article more the appearance of pewter than silver. When it wants cleaning, rub it with a piece of soft leather and prepared chalk, the latter made into a kind of paste with pure water, for the reason that water not pure might contain gritty particles.

TO CLEANSE BRUSHES.—The best method of cleansing watchmakers' and jewellers' brushes is to wash them out in strong soda water. When the backs are wood, you must favor that part as much as possible; for being glued, the water may injure them.

TO CUT GLASS ROUND OR OVAL WITHOUT A DIAMOND.—Scratch the glass around the shape you desire with the corner of a file or graver; then, having bent a piece of wire in the same shape, heat it red hot and lay it upon the scratch, sink the glass into cold water just deep enough for the water to come almost on a level with its upper surface. It will rarely ever fail to break perfectly true.

TO RE-BLACK CLOCK HANDS.—Use asphaltum varnish. One coat will make old rusty hands look as good as new, and it dries in a few minutes.

TO GILD STEEL.—Pour some of the ethereal solution of gold into a wineglass, and dip into it the blade of a new penknife, razor, lancet, &c.; withdraw the instrument, and allow the ether to evaporate. The blade will then be found covered with a beautiful coat of gold. The blade may be moistened with a clean rag, or a small piece of very dry sponge dipped in the ether, and the same effects will be produced.

SILVERING SHELLS.—Silver-leaf and gum water a sufficient quantity; grind to a proper thickness, and cover the inside of the shells. For a GOLD COLOR, grind up gold-leaf with gum water, and apply to the inside of the shells.

LIQUID FOIL FOR SILVERING GLASS GLOBES, &C.—Lead, 1 part; tin, 1 part; bismuth, 1 part: melt, and, just before it sets, add mercury, 10 parts. Pour this into the globe, and turn it rapidly round.

SILVER-PLATERS' STRIPPING LIQUID.—Sulphuric acid, 8 parts; nitre, 1 part. Used to recover silver from old plated ware.

TO SILVER CLOCK-FACES, ETC.—Old silver lace, $\frac{1}{2}$ oz.; nitric acid, 1 oz. Boil them over a gentle fire for about 5 minutes in an earthen pot. After the silver is dissolved, take the mixture off, and mix it in a pint of clean water, then pour it into another vessel

free from sediment; then add a tablespoonful of common salt, and the silver will be precipitated in the form of a white powder or curd; pour off the acid, and mix the curd with 2 oz. salt of tartar, and $\frac{1}{2}$ oz. whiting, all together, and it is ready for use. To Use.—Clean your brass or copper plate with rotten stone and a piece of old hat; rub it with salt and water with your hand. Then take a little of the composition on your finger, and rub it over your plate, and it will firmly adhere and completely silver it. Wash it well with water. When dry, rub it with a clean rag, and varnish with this VARNISH FOR CLOCK-FACES. Spirits of wine, 1 pt.; divide into three parts, mix one part with gum-mastic in a bottle by itself; 1 part spirits and $\frac{1}{2}$ oz. sandarach in another bottle; and 1 part spirits and $\frac{1}{2}$ oz. of whitest gum benjamin, in another bottle; mix and temper to your mind. If too thin, some mastic; if too soft, some sandarach or benjamin. When you use it, warm the silvered plate before the fire, and, with a flat camel's-hair pencil, stroke it over till no white streaks appear, and thus will preserve the silvering for many years.

REFINING GOLD AND SILVER.—The art of assaying gold and silver is founded upon the feeble affinity which these have for oxygen in comparison with copper, tin, and other cheap metals, and on the tendency which the latter metals have to oxidize rapidly in contact with lead at a high temperature, and sink with it into any porous, earthy vessel in a thin, glassy, vitrified mass. The precious metal having previously been accurately weighed and prepared, the first process is CUPELLATION. The muffle, with cupel properly arranged on the "muffle plate," is placed in the furnace, and the charcoal added, and lighted at the top by means of a few ignited pieces thrown on last. After the cupels have been exposed to a strong white heat for about half an hour, and have become white hot, the lead is put into them by means of tongs. As soon as this becomes bright red and "circulating," as it is called, the specimen for assay, wrapped in a small piece of paper or lead-fil, is added; the fire is now kept up strongly until the metal enters the lead and "circulates" well, when the heat, slightly diminished, is so regulated that the assay appears convex and more glowing than the cupel itself, whilst the "undulations" circulate in all directions, and the middle of the metal appears smooth, with a margin of litharge, which is freely absorbed by the cupel. When the metal becomes bright and shining, or, in technical language, begins to "lighten," and prismatic hues suddenly flash across the globules, and undulate and cross each other, followed by the metal becoming very brilliant and clear, and at length bright and solid (called the *brightening*), the separation is ended, and the process complete. The cupels are then drawn to the mouth of the "muffle," and allowed to cool slowly. When quite cold, the resulting "button," if of SILVER, is removed by the "pliers" or "tongs" from the cupels, and, after being flattened on a small anvil of polished steel, with a polished steel hammer, to detach adhering oxide of lead, and cleaned with a small, hard brush, is very accurately weighed. The weight is that of pure silver, and the difference between the weight before cupellation and that of the pure metal represents the proportion of alloy in the sample examined. In the case of GOLD, the metal

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has next to undergo the operations of QUARTATION. The cupelled sample is fused with 3 times its weight of pure silver, (called the "witness"), by which the gold is reduced to one-fourth of the mass, less, and in this state may easily be removed by PARTING. The alloy, after quartation, is hammered or rolled out into a thin strip or leaf, curled into a spiral form, and boiled for a quarter of an hour with about $2\frac{1}{2}$ to 3 oz. of nitric acid (specific gravity, 1.3); and the fluid being poured off, it is again boiled in a similar manner, with $1\frac{1}{2}$ to 2 oz. more nitric acid (sp. gr., 1.2); after which the gold is carefully collected, washed in pure water, and dried. When the operation of parting is skillfully conducted, the acid not too strong, the metal preserves its spiral form; otherwise it falls into flakes or powder. The second boiling is termed the "*reprise*." The loss of weight by parting corresponds to the quantity of SILVER originally in the specimen.

FOR ALLOYS CONTAINING PLATINUM, which usually consist of copper, silver, platinum, and gold, the method of assaying is as follows: The alloy is cupelled in the usual way, the loss of weight expresses the amount of *copper*, and the "button," made into a riband and treated with sulphuric acid, indicates by the portion dissolved that also of the *silver* present. By submitting the residuum to quartation, the *platinum* becomes soluble in nitric acid. The loss after digestion in this menstruum expresses the weight of that metal, and the weight of the portion now remaining is that of pure gold. Gold containing PALLADIUM may be assayed in the same manner. ANNEALING.—This consists in putting the pure gold into a small, porous crucible, or cupel, and heating it to redness in the muffle. WEIGHING must be done with the utmost accuracy. The weight in grains Troy, doubled or quadrupled, as the case may be, gives the number of *carats fine* of the alloy examined, without calculation.

According to the OLD FRENCH METHOD of assaying gold, the following quantities were taken: For the *assay pound*, 12 gr.; fine silver, 0 gr.; lead, 108 gr. These having been cupelled together, the perfect button is rolled into a leaf ($1\frac{1}{2} \times 5$ inches), twisted on a quill, and submitted to parting with $2\frac{1}{2}$ oz. and $1\frac{1}{2}$ oz. of nitric acid, sp. gr., 1.16 (20° Baume.) The remainder of the process is similar to that above described.

The usual weight of silver taken for the *assay pound*, when the fineness is reckoned in 1000ths, is 20 gr., every real grain of which represents 50-1000ths of fineness, and so on of smaller divisions.

ENAMELLING ON GOLD OR COPPER.—The basis of all enamels is a highly transparent and fusible glass, called FRIT, FLUX, or PASTE, which readily receives a color on the addition of the metallic oxides. *Preparation*.—Red lead, 16 parts; calcined borax, 3 parts; pounded flint glass, 12 parts; flints, 4 parts. Fuse in a Hessian crucible for 12 hours, then pour it out into water, and reduce it to powder in a biscuit-ware mortar. The following directions will serve to show how the coloring preparations are made: *Black* enamels are made with peroxyde of manganese, or protoxyde of iron, to which more depth of color is given with a little cobalt. *Violet* enamel of a very fine hue is made from peroxyde of man-

ganese in small quantity, with saline or alkaline fluxes. *Red enamel* is made from protoxyde of copper. Boil a solution of equal parts of sugar and acetate of copper in four parts of water. The sugar takes possession of a portion of the cupreous oxide, and reduces it to the protoxyde; when it may be precipitated in the form of a granular powder of a brilliant red. After about two hours of moderate boiling, the liquid is set aside to settle, decanted off the precipitate, which is washed and dried. By this pure oxide any tint may be obtained from red to orange by adding a greater or smaller quantity of peroxyde of iron. The oxide and purple of Cassius are likewise employed to color red enamel. This composition resists a strong fire very well. *Green enamel* can be produced by a mixture of yellow and blue, but is generally obtained direct from the oxide of copper, or, better still, with the oxide of chrome, which last will resist a strong heat. *Yellow*.—Take one part of white oxide of antimony, with from one to three parts of white lead, one of alum, and one of sal-ammoniack. Each of these substances is to be pulverized, then all are to be exactly mixed, and exposed to a heat adequate to decompose the sal-ammoniack. This operation is judged to be finished when the yellow color is well brought out. *Blue*.—This color is obtained from the oxide of cobalt, or some of its combinations, and it produces it with such intensity that only a very little can be used lest the shade should pass into black. A *white enamel* may be prepared with a calcine formed of 2 parts of tin and 1 of lead, calcined together: of this combined oxide, 1 part is melted with 2 parts of fine crystal and a very little manganese, all previously ground together. When the fusion is complete, the vitreous matter is to be poured into clear water, and the frit is then dried and melted anew. Repeat the pouring into water three or four times, to insure a perfect combination. Screen the crucible from smoke and flame. The smallest portions of oxide of iron or copper admitted into this enamel will destroy its value.

The artist prepares his enamel colors by pounding them in an agate mortar, with an agate pestle, and grinding them on an agate slab, with oil of lavender rendered viscid by exposure to the sun, in a shallow vessel, loosely covered with gauze or glass. He should have alongside of him a stove, in which a moderate fire is kept up, for drying his work whenever the figures are finished. It is then passed through the muffle.

SILVER-PLATING.—File the parts which are to receive the plate very smooth; then apply over the surface the muriate of zinc, which is made by dissolving zinc in muriatic acid; now hold this part over a dish containing hot soft solder, and with a swab apply the solder to the part to which it will adhere, brush off all superfluous solder, so as to leave the surface smooth; you will now take No. 2 fair silver plate, of the right size to cover the prepared surface, and lay the plate upon it, and rub down smooth with a cloth moistened with oil; then, with a tinned soldering iron, pass slowly over all the surface of the plate, which melts the solder underneath it, causing the plate to adhere as firmly as the solder does to the iron; then polish the surface, and finish with buckskin.

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ELKINGTON'S PATENT GILDING.—Fine gold, 5 oz. (troy); nitro-muriatic acid, 52 oz. (avoirdupois); dissolve by heat, and continue the heat until red or yellow vapors cease to be evolved; decant the clear liquor into a suitable vessel; add *distilled* water, 4 gals.; pure bi-carbonate of potassa, 20 lbs.; and boil for 2 hours. N.B.—The nitro-muriatic acid is made with *pure* nitric acid (sp. gr., 1.45) 21 oz.; *pure* muriatic acid (sp. gr., 1.15), 17 oz.; and *distilled* water, 14 oz.

The articles, after being perfectly cleaned from scale or grease, and receiving a proper *face*, are to be suspended on wires, dipped into the liquid *boiling hot*, and moved about therein, when, in from a few seconds to a minute, depending on the newness and strength of the liquid, the requisite coating of gold will be deposited on them. By a little practice the time to withdraw the articles is readily known; the duration of the immersion required to produce any given effect gradually increases as the liquid weakens by use. When properly gilded, the articles are withdrawn from the solution of gold, washed in clean water and dried; after which they undergo the usual operation of coloring, &c.

▲ *"dead gold"* appearance is produced by the application to the articles of a *weak* solution of *nitrate of mercury* previously to the immersion in the gilding liquor, or the *deadening* may be given by applying a solution of the nitrate to the *newly gilded* surface, and then expelling the mercury by heat.

SPOT GILDING, or gilding in spots, producing a very fine appearance, is done by putting a thin coat of oil on those parts of the metal where you do not wish the gilding to appear, the gold will then be deposited on those spots only where there is no oil, and the oil is easily removed when the job is finished.

WATCHMAKERS' OIL.—Insert coils of thin sheet lead into olive oil in a bottle, expose it to the sun for a few weeks, and pour off the clear.

SOLUTION FOR DIPPING STEEL ARTICLES, PREVIOUS TO ELECTRO-PLATING.—Nitrate of silver, 1 part; nitrate of mercury, 1 part; nitric acid (sp. gr., 1.384), 4 parts; water, 120 parts. *For copper articles.*—Sulphuric acid, 64 parts; water, 64 parts; nitric acid, 32 parts; muriatic acid, 1 part; mix. The article, free from grease, is dipped in the pickle for a second or two.

POLISHING DIAMONDS.—The plan in use at all the large diamond cutters is simply a cast iron disc of good metal, with a vertical spindle run through its centre, balanced, and turned, and faced true in a lathe. The disc revolves at about 1000 revolutions per minute. With a little diamond dust and oil the stone is set in a small brass cup filled with common soft solder; it is then screwed up in the clamps and applied to the skive till the facet is formed.

RECEIPTS FOR MACHINISTS, ENGINEERS, MILLOWNERS, BLACKSMITHS, LOCOMOTIVE BUILDERS, &c., &c., AND METAL WORKERS OF EVERY KIND.

ON SAWMILLS.—How to GET THE MOST LUMBER FROM SAWLOGS.—Experience has abundantly proved to our satisfaction that this can

be done only by the use of the circular saw. Human ingenuity, thanks be to the Giver of all Good, has been so prolific in the invention and construction of this kind of machinery, that the principal difficulty with the intending purchaser seems to be an inability to decide whose machine is really the best. Every builder or inventor of a rotary sawmill appears to claim for his machine such a perfect constellation of most desirable features, that a certain amount of hesitation in coming to a decision seems to be inevitable. Having tried the up and down saw and the circular saw also, we would again repeat our conviction that the last mentioned is the best for manufacturing lumber, and should any person act on this expression of opinion, let him in the first place be very careful to get if possible the best machine, bring it to the mill, and set it perfectly level and true. When you get it in operation, see that you handle it carefully. If you have been used to running the up and down saw only, you will soon find out that your former experience avails almost nothing in the management of the rotary machine; but when you get the hang of running it, the compensation in the way of convenience, rapidity, and quantity of work, is immense. Some prefer to use the inserted tooth saws, and will use no other. They seem to possess many advantages, and are entirely safe. A late invention of *spreading the upper part of the tooth towards the point* during the process of manufacture, spreading it out so as to make the point of the tooth the *thickest part of the circumference of the saw*, enables the sawyer to dispense in a great measure with the use of the swage. Those inserted tooth saws which do not possess this improvement must be carefully swaged and filed at least twice per day, and sometimes as often as six or seven times per day, depending upon the kind of lumber being cut. In filing or swaging the saw, be careful to form the point of the teeth absolutely square, and even across, the slightest deviation from perfect truth in this respect being apt to cause the saw to *run*, as it is termed, or vary from its proper course while passing through the log. Some prefer to form the point of the tooth a little hooking, just enough so as to be barely perceptible, and in swaging to use *that part of the die belonging to the swage*, which gives the tooth of the saw a slightly curved or rainbow form, something in this shape , or scarcely so much curved. One sawyer of 20 years' experience in running machinery, informed us that he never did better or more rapid work with his mill than when he kept his saw exactly right on these two points just stated. If you can run a No. 7 gauge saw on your mill, the loss resulting from sawdust will be very slight, and as large saws are generally thickest at the centre, tapering off towards the circumference, this size or No. 6 will, as a general rule, be found sufficiently strong for most purposes. Make sure at all times, especially during frosty weather, that the dogs have a secure hold of the log before the saw enters it. It is only a few days ago that a case came to my knowledge of a firm near Fredericton, N.B., having sustained a severe loss by a log (insufficiently secured, of course) canting over on the saw as it was passing through it. The effect was to break off the saw from the mandrel, twist off the nut at the end near the saw, and break away the two iron pins used for securing the saw in the collar, causing a stop

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an ingenuity, in the invention of the principal an inability to order or inventor ne such a per- certain amount be inevitable. r saw also, we mentioned is the person act on be very careful mill, and set it on, see that you ing the up and mer experience otary machine; pensation in the rk, is immense. ll use no other, ntirely safe. A both towards the g it out so as to circumference of t measure with s which do not ed and filed at or seven times cut. In filing or the teeth abso- on from perfect to run, as it is ing through the little hooking, swaging to use gives the tooth ing in this shape ears' experience d better or more w exactly right a No. 7 gauge st will be very at the centre, r No. 6 will, as a purposes. Make r, that the dog it. It is only e of a firm new a log (insuffic- as it was passing om the mandr- k away the tw- causing a stop

page of the mill, and the consequent expense of repair and delay. When you get the mill in operation, see that you handle it carefully, and maintain unceasing watchfulness over her while in operation. Give her *plenty of power*; if you *don't*, you may as well shut up shop at once; *good attendance*, and with a good machine, the attendants will not have much time to play themselves, I can assure you. Keep all the parts well *oiled*—that has a great deal to do with the smooth and successful running of the machine; and, by the way, I would remark that sawmills are not the only things in this world that run all the better for being oiled. If that kind, loving, gentle, and affectionate spirit of which *oil* is the symbol, pervaded the hearts and minds of our race, and found universal expression in every thought, word, and deed during our daily intercourse with each other, it would be a very different world from what it is—better for ourselves, and better for our neighbors. Let us all carry on *this branch of the oil business* as extensively as possible, and we shall soon see a brotherhood “dwelling together in unity.” In order to facilitate calculations regarding the velocity of saws, herewith is appended a reliable table to serve as a guide in ascertaining the proper speed for running:—

TABLE OF SPEED FOR CIRCULAR SAWS.

36 inches in diameter, 1000 revolutions per minute.

38	"	"	950	"	"
40	"	"	900	"	"
42	"	"	870	"	"
44	"	"	840	"	"
46	"	"	800	"	"
48	"	"	760	"	"
50	"	"	725	"	"
52	"	"	700	"	"
54	"	"	675	"	"
56	"	"	650	"	"
58	"	"	625	"	"
60	"	"	600	"	"
62	"	"	575	"	"
64	"	"	560	"	"
66	"	"	545	"	"
68	"	"	530	"	"
70	"	"	515	"	"
72	"	"	500	"	"
74	"	"	485	"	"
76	"	"	475	"	"

WHO MAKE THE BEST SAW-MILLS AND SAWS.—The parties engaged in this business who may be called first class men in their line are so numerous, that it is hard to tell where to begin or where to leave off in making honorable mention. C. H. Waterous & Co., of Brantford, Ont., have the reputation of turning out first class circular saw mills, and portable engines to drive them. They have sent many of their mills down to New Brunswick, where the gang-saw has been doing most of the business hitherto, and they appear to be giving satisfaction. The Joseph Hall Mfg. Co., Oshawa, Ont., Mr. Glen, president, also rank very high. The same may be

said of W P Bartley & Co., of Montreal; James Harris, of the New Brunswick Foundry, St. John, N.B. Messrs. McFarlane & Anderson, of St. Mary's and Fredericton, N.B., with their two establishments—the one at the latter place being quite extensive, and lately rebuilt at great cost since the fire which destroyed it in the summer of 1871—are now fully prepared to execute any orders for saw-mills, steam engines, &c., at reasonable rates. For the benefit of those residing in the United States, we may mention that Stearns, Clark, & Co., of Erie, Pa., turn out the very best of work. Having made a personal examination of their facilities and appliances, we say that they rank second to none, and, in proof of this, would state that we saw a letter in the "Scientific American" a few days ago, from a party who was running one of their mills in Wisconsin, if we mistake not, making the statement that he had cut upwards of 60,000 feet in one day with one of their circular saw-mills. That was big business, but the work was done, and the figures produced to prove it from a disinterested source. There are also one or two firms in Bangor, Me., who turn out good machinery for saw-mills; but it is almost invidious to mention isolated firms where there is such an aggregation of excellent houses in this business all over the United States and Canada. In the line of saw manufacturers we would enumerate Morland & Watson, and James Robertson, of Montreal, Alex. Richardson & Co., of St. John, N.B., and J. F. Lawton, also of St. John, as bearing the reputation of turning out good work. In the United States we have honorable and able firms bearing the names of Welch & Griffiths of Boston, the Providence Saw Co., Providence, R.I., who make inserted tooth saws only; R. Hoe & Co., of New York; the American Saw Co., New York; Disston of Philadelphia; Porter Saw Co., Bristol, Conn.; Hubbard of Pittsburg, Pa.; Atkins of Indianapolis, Ind.; Messrs. Sinker & Co., of the same place; Mellus of Detroit, Mich.; Branch, Crookes, & Co., of St. Louis, Mo., and one or two good firms in Cleveland, Ohio.

SHINGLE MACHINES.—There are numerous good machines of this class, very highly recommended by the different manufacturers as a matter of course, but the *interested* representations as to their capability of performing such incredible prodigies of work in a day, are most generally to be taken at a "liberal discount," as the dry goods merchant most eloquently expresseth it. Having had rather unusual opportunities of witnessing the performance of various kinds of shingle machines, I will specify a few, premising, in the first place, that I am neither interested in the sale of shingle or any other machines, nor in the receipt of "a valuable consideration" from the manufacturers for recommending them. James Harris of St. John, N.B., has built a large number of the Close shingle machines (vertical saw) during the year 1871. I hear them highly spoken of, and have seen one, but not in operation. I should judge it was a very good machine, price \$175, with a Bangor edger or trimmer, \$25 extra. The Muzzey Iron Works Company, Bangor, Me., build a very good shingle machine (vertical saw); I have seen many in operation; they will turn out a good deal of work, and do it well. Trevor and Co., of Lockport, N.Y., turn out very good shingle and heading machines (vertical

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saw) As a proof of their popularity, I may state that Mr. T. Thompson, of Black Rock, N.Y., has four or five of these shingle machines in operation, and prefers them to all others. I can also bear witness that M. Badger and Co., of Rochester, N.Y., build excellent shingle and heading machines (horizontal saw), and are really deserving of approbation and patronage, not only on account of turning out good machinery, but from the circumstance that the proprietors are two young ladies (who have inherited the business of their father, now many years deceased) who attend personally to the management of the financial part of the business, while the superintendent, Mr. Doughty, is possessed of every qualification to ensure good work in the mechanical department. I would also mention James E. Austin and Co., of Oswego, N.Y., as a firm who have expended a great deal of money and much ingenuity in the invention and manufacture of shingle machines, and have brought them to a point of perfection which leaves little more to be desired. Although the machine is quite complicated, it can be speeded up to cut very rapidly. One gentleman in Oswego informed me that he had cut as high as 33,000 shingles per day. I should say that that was an extra day's work, but it must be borne in mind that the machine carries two blocks at one time, cutting a shingle from each block alternately. This machine also requires a smart careful operator; any negligence on his part will undoubtedly be rewarded with a shower of dangerous projectiles, flying "fast and furious," not at all careful who or where they strike. The price of this machine is \$600. I have seen only one shingle machine that could compete with Austin's. This was in Chicago previous to the great fire, and it could cut about 8000 shingles per hour. I was informed that it was made in Wisconsin, and cost \$1400. Many other good machines are made by other makers besides those mentioned above, but space will not admit of further mention. Any enquiries addressed to either of the aforesaid manufacturers will be answered by illustrated circulars containing full information. In the manufacture of shingles, as well as in anything else; it is the wisest policy to use the best materials. Get good rift, free from knots, sand, bark, &c., and you will inevitably get good merchantable stuff, with less waste and more pleasure every way, both with the machinery in the first place, and the satisfactory state of your exchequer in the last. It is all the better if you can lay in a good stock one year ahead, as it cuts much easier when properly seasoned, to say nothing of the saving in weight during transportation. In edging shingles, many prefer the saw to the revolving knives, as it enables the operator in many cases to get a shingle of extra quality by trimming a poor shingle down, and selecting the best part. This can be done by a smart hand with marvellous rapidity, but still, to use a modern phrase, many persons can't see it, and so they use the knives, giving what they conceive to be good reasons for so doing.

VELOCITY OF WHEELS, PULLEYS, DRUMS, &C.—When wheels are applied to communicate motion from one part of a machine to another, their teeth act alternately on each other; consequently, if one wheel contains 60 teeth, and another 20 teeth, the one con-

taining 20 teeth will make 3 revolutions while the other makes but 1; and if drums or pulleys are taken in place of wheels, the effect will be the same; because their circumferences, describing equal spaces, render their revolutions unequal; from this the rule is derived, namely:—

Multiply the velocity of the driver by the number of teeth it contains, and divide by the velocity of the driven. The quotient will be the number of teeth it ought to contain; or, multiply the velocity of the driver by its diameter, and divide by the velocity of the driven.

Example 4. If a wheel that contains 75 teeth makes 16 revolutions per minute, required the number of teeth in another, to work into and make 24 revolutions in the same time. According to rule, you multiply 16 by 75, and divide the product, which is 1200, by 24, and you have the answer, 50 teeth.

Example 5. Suppose a drum, 30 inches in diameter, to make 20 revolutions in a minute, required the diameter of another to make 60 revolutions per minute. According to rule, you multiply 20 by 30, and divide the product, which is 600, by 60, and you have the answer, 10 inches.

Example 6. A wheel 64 inches in diameter, and making 42 revolutions per minute, is to give motion to a shaft at the rate of 77 revolutions in the same time; find the diameter of a wheel suitable for that purpose. According to rule, multiply 42 by 64, and divide the product, which is 2688, by 77, and you will have for the answer 35 inches nearly.

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Example 7. Suppose a pulley 32 inches diameter to make 26 revolutions; find the diameter of another to make 12 revolutions in the same time.

According to rule, $26 \times 32 \div 12 = 69 \frac{1}{3}$ —

26 and 12) 832. This will be seen to be $69 \frac{1}{3}$

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$$69 \frac{1}{3} = 1$$

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Example 8. Find the number of revolutions per minute made by a wheel or pulley 20 inches in diameter, when driven by another 48 inches in diameter, and making 45 revolutions in the same time. According to rule, $48 \times 45 \div 20 = 108$. That is, 48 multiplied by 45 = 2160, divided by 20, gives the answer, 108 revolutions.

A leather belt should have a velocity of about 1300 feet per minute, and not more than 1800 feet, or it will not last long. If the lightning pulley is used too strong, it increases friction in the gudgeons of the shaft, and prematurely destroys the belt.

TO INCREASE THE POWER AND DURABILITY OF RUBBER BELTING. Apply the following composition with a painter's brush, and let it dry:—Red lead, black lead, French yellow, and litharge, equal

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parts; mix with boiled linseed oil and japan sufficient to make it dry quick. This will produce a highly-polished surface. Should the belt slip, moisten lightly on the side next the pulley with linseed oil, and repeat the application if necessary.

BELTING FRICTION.—The friction by belting on pulleys is 47 for greased leather, when run on wood drums or pulleys; 50 for dry leather on wood; 38 for oiled leather on cast-iron pulleys; and 28 for dry leather on cast-iron pulleys.

BELGIAN WELDING POWDER.—Iron filings, 1000 parts; borax, 500 parts; balsam of copaiba, or other resinous oil, 50 parts; sal-ammoniac, 75 parts. Mix all well together, heat, and pulverize completely. The surfaces to be welded are powdered with the composition, and then brought to a cherry red heat, at which the powder melts, when the portions to be united are taken from the fire and joined. If the pieces to be welded are too large to be both introduced into the forge, one can be first heated with the welding powder to a cherry red heat, and the other afterwards to a white heat, after which the welding may be effected.

COMPOSITION USED IN WELDING CAST STEEL.—Borax, 10 parts; sal-ammoniac, 1 part; grind or pound them roughly together; then fuse them in a metal pot over a clear fire, taking care to continue the heat until all spume has disappeared from the surface. When the liquid appears clear, the composition is ready to be poured out to cool and concrete; afterwards being ground to a fine powder, it is ready for use. To use this composition, the steel to be welded is raised to a heat which may be expressed by "bright yellow;" it is then dipped among the welding powder, and again placed in the fire until it attains the same degree of heat as before: it is then ready to be placed under the hammer.

TEMPERING STEEL SPRINGS.—The steel used should be that called "spring" for large work; for small work, "double shear." After hardening in the usual way, in water, or, as some prefer, in oil, dry the spring over the fire to get rid of its moisture, then smear it over with tallow or oil, hold it over the flame of the smith's forge, passing it to and fro, so that the whole of it will be equally heated, holding it there until the oil or tallow takes fire. Take the article out of the fire and let it burn a short time, then blow it out. This process may be repeated two or three times if the operator fancies that any portion of the spring has not been reduced to the proper temperature, or rather, raised to it.

TEMPERING SAWS.—A late improvement consists in tempering and straightening the saws at one operation. This is done by heating the saws to the proper degree, and then pressing them with a sudden and powerful stroke between two surfaces of cold iron. A drop press is employed for the purpose. The mechanism is quite simple and inexpensive. Its use effects an important economy in the manufacture of nearly all kinds of saws, and also improves their quality.

TEMPERING LIQUID.—Water, 3 gals.; soda, 2 oz.; saltpetre, 2 oz.; prussic acid, 1 oz., or oil of vitriol, 2 oz.

TEMPERING SPIRAL SPRINGS.—Place a piece of round iron inside the spring large enough to fill it; then make the spring and iron red hot, and, when hot place them quickly into cold water, and

stir them about till cold; afterwards rub them with oil or grease, and move them about in a flame till the grease takes fire; the spring will then be reduced to its proper temper.

TO SOFTEN MALLEABLE IRON.—When your furnace is charged with fuel and metal, get the fire up to a dull red heat, then pour fluoric acid all over the coke; use $\frac{1}{2}$ pt. to 1 pt. or even 1 qt., adding a handful of fluor spar; it will make the metal much softer.

CHILLED IRON.—At Lister's Works, Darlington, England, some articles required turning in the lathe, and cast steel could not be made hard enough to cut them. One man proposed cast metal tools. He was laughed at, of course, but his plan had to be tried. Well, cast metal tools were tried, with points chilled, and they cut when cast steel tools were of no use. The article was turned up with metal tools.

DRILLING HOLES IN CAST IRON.—By means of carboric acid a hole $\frac{1}{4}$ of an inch in diameter has been drilled through $\frac{1}{4}$ inch thickness of cast iron, with a common carpenter's brace; judge, then, what can be done by using the acid and pressure drill.

TO RESTORE BURNT STEEL AND IMPROVE POOR STEEL.—Borax, 3 oz.; sal-ammoniac, 8 oz.; prussiate of potash, 3 oz.; blue clay, 2 oz.; resin, $\frac{1}{4}$ lb.; water, 1 gill; alcohol, 1 gill. Put all on the fire, and simmer till it dries to a powder. The steel is to be heated, dipped into this powder, and afterwards hammered.

COMPOSITION TO TOUGHEN STEEL.—Resin, 2 lbs.; tallow, 2 lbs.; black pitch, 1 lb.; melt together, and dip in the steel when hot.

BURGLAR AND DRILL-PROOF DIAMOND CHILL.—Take 1 gal. urine, and add to it 1 oz. borax and 1 oz. salt.

TO RE-CUT OLD FILES.—Remove the grease and dirt from your files by washing them in warm potash water, then wash them in warm water, and dry with artificial heat; next, place 1 pt. warm water in a wooden vessel, and put in your files, add 2 oz. of blue vitriol, finely pulverized, 2 oz. of borax, well mixed, taking care to turn the files over, so that each one may come in contact with the mixture. Now add 7 oz. sulphuric acid and $\frac{1}{4}$ oz. cider vinegar to the above mixture. Remove the files after a short time, dry, sponge them with olive oil, wrap them up in porous paper, and put aside for use. Coarse files require to be immersed longer than fine.

SUBSTITUTE FOR BORAX.—Copperas, 2 oz.; saltpetre, 1 oz.; common salt, 6 oz.; black oxide of manganese, 1 oz.; prussiate of potash, 1 oz.; all pulverized and mixed with 3 lbs. of nice welding sand, and use the same as you would sand. High-tempered steel can be welded with this at a lower heat than is required for borax.

TEMPERING LIQUID FOR MILL PICKS.—Rain water, 3 gals.; spirits of nitre, 3 oz.; hartshorn, 3 oz.; white vitriol, 3 oz.; alum, 3 oz.; sal-ammoniac, 3 oz.; salt, 6 oz.; with 2 handfuls of the parings of horse's hoofs. The steel to be heated to a cherry red. A large jug of this preparation should be kept corked tight, to keep its strength from being lost by evaporation.

TO SOFTEN IRON OR STEEL.—Either of the following methods will make iron or steel very soft:—1. Anoint it all over with tallow, temper it in a gentle charcoal fire, and let it cool of itself. 2. Take a little clay, cover your iron with it, temper in a charcoal fire. 3. When the iron or steel is red hot, strew hellebore on it

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4. Quench the iron or steel in the juice or water of common beans.

TO FILE A SQUARE HOLE.—To file a hole square, it is necessary to reverse the work very often; a square file should first be used, and the holes finished with either a diamond-shaped file, or a half round. This leaves the corners square, as they properly should be.

TO TEMPER SMALL SPRINGS.—*In large quantities.*—First, harden them in the usual manner of hardening steel; then place as many as convenient in a vessel containing oil. Heat the oil containing the springs until it takes fire from the top, then set off the vessel and let it cool. The springs will then be found to possess the required temper.

TEMPERING.—The article, after being completed, is hardened by being heated gradually to a bright red, and then plunged into cold water: it is then tempered by being warmed gradually and equably, either over a fire, or on a piece of heated metal, till of the color corresponding to the purpose for which it is required, as per table below, when it is again plunged into water.

Corresponding temperature.

A very pale straw.....	430	Lancets }	
Straw.....	450	Razors }	
Darker straw.....	470	Penknives }	All kinds of wood tools,
Yellow.....	490	Scissors }	Screw taps.
Brown yellow.....	500	Hatchets, Chipping Chisels,	
Slightly tinged purple	520	Saws.	
Purple.....	530	All kinds of percussive tools.	
Dark purple.....	550	} Springs.	
Blue.....	570		
Dark blue.....	600	Soft for saws.	

CRUCIBLES.—The best crucibles are made from pure fire-clay, mixed with finely-ground cement of old crucibles, and a portion of black-lead or graphite; some pounded coke may be mixed with the plumbago. The clay should be prepared in a similar way as for making pottery-ware; the vessels, after being formed, must be slowly dried, and then properly baked in the kiln.

Black-lead crucibles are made of 2 parts graphite, and 1 of fire-clay, mixed with water into a paste, pressed in moulds, and well dried, but not baked hard in the kiln. This compound forms excellent small or portable furnaces.

TEMPERING RAZORS, CUTLERY, SAWS, &c.—Razors and penknives are too frequently hardened without the removal of the scale arising from the forging: *this practice, which is never done with the best works, cannot be too much deprecated.* The blades are heated in a coke or charcoal fire, and dipped in the water obliquely. In tempering razors, they are laid on their backs upon a clean fire, about half-a-dozen together, and they are removed one at a time, when the edges, which are as yet thick, come down to a pale-straw color. Should the backs accidentally get heated beyond the straw-color, the blades are cooled in water but not otherwise. Pen-blades are tempered a dozen or two at a time, on a plate of iron or copper, about 12 inches long, 3 or 4 inches wide, and about $\frac{1}{4}$ of an inch thick. The blades are arranged close together on their backs

and lean at an angle against each other. As they come down to the temper, they are picked out with small pliers and thrown into water if necessary; other blades are then thrust forward from the cooler parts of the plate to take their place. Axes, adzes, cold chisels, and other edge tools, in which the total bulk is considerable compared with the part to be hardened, are only partially dipped: they are afterwards let down by the heat of the remainder of the tool; and, when the color indicative of the temper is attained, they are entirely quenched. With the view of removing the loose scales, or the oxydation acquired in the fire, some workmen rub the objects hastily in dry salt before plunging them in the water, in order to give them a cleaner and brighter face.

Oil, or resinous mixtures of oil, tallow, wax, and resin, are used for many thin and elastic articles, such as needles, fish-hooks, steel pens and springs, which require a milder degree of hardness than is given by water. Gun lock-springs are sometimes *fried in oil* for a considerable time over a fire, in an iron tray; the thick parts are then sure to be sufficiently reduced, and the thin parts do not become the more softened from the continuance of the blazing heat.

Saws and springs are generally hardened in various compositions of oil, suet, wax, &c. The saws are heated in long furnaces, and then immersed horizontally and edgewise into a long trough containing the composition. Part of the composition is wiped off the saws with a piece of leather, when they are removed from the trough, and heated one by one, until the grease inflames. This is called "*blazing off*." The composition used by a large saw manufacturer is 2 lbs. suet, and $\frac{1}{4}$ lb. of bees'-wax, to every gallon of whale oil; these are boiled together, and will serve for thin works and most kinds of steel. The addition of black resin, about 1 lb. to each gallon, makes it serve for thicker pieces, and for those it refused to harden before; but resin should be added with judgment, or the works will become too hard and brittle.

TO REDUCE OXIDE OF ZINC.—The oxide may be put in quantities of 500 or 600 lbs. weight into a large pot over the fire; pour a sufficient quantity of muriatic acid over the top, to act as a flux, and the action of the fire will melt the dross, when the pure metal will be found at the bottom of the pot.

TO TEMPER TAPS OR REAMERS without springing, select your steel for the job, and forge the tap with a little more than the usual allowance, being careful not to heat too hot nor hammer too cold; after the tap or reamer is forged, heat it and hold it on one end on the anvil. If a large one, hit it with the sledge; if a small one, the hammer will do. This will cause the tap to bend slightly. Do not straighten it with the hammer, but on finishing and hardening the tap, it will become straight of its own accord.

TO HARDEN AND TEMPER CAST STEEL.—For saws and springs in general the following is an excellent liquid: Spermaceti oil, 20 gals.; beef suet *rendered*, 20 lbs.; neat's-foot oil, 1 gal.; pitch, 1 lb.; black resin, 3 lbs. The last two articles must be previously melted together, and then added to the other ingredients, when the whole must be heated in a proper iron vessel, with a close cover fitted to it, until all moisture is evaporated, and the compo-

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VULCANITE EMERY WHEELS.—Use a compound of India rubber, and Wellington mills emery, as little of the former as will suffice to hold the particles of emery together. The materials must be thoroughly incorporated together, then rolled into sheets, cut into wheels of the desired size and pattern, pressed into iron moulds, and vulcanized or cured by being subjected to a high degree of steam heat for several hours, making it almost as hard as cast iron.

TO BRAZE A BAND SAW.—*Whitney's method.*—The tools required are a small portable forge, brazing clamps, &c, and a straight edge, 3 or 4 feet long, also some brass wire and powdered borax. Take the saw and cut it to the proper length, scarf the ends from one half to three-fourths of an inch, then put the saw in the clamps. I would say that I use a very small and simple clamp in the shape of a double vise. Keep the back of the saw out of the jaws of the vise, or clamps, and apply the straight edge to the back, as it is very necessary to braze it straight; make the fire in as small a compass as possible; place the clamps directly over the centre of the fire, and then put on three pieces of brass wire, bent in the form of the letter U, so that they will pinch the laps together; put on as much borax as will lie on the saw, cover the whole with a piece of charcoal; melt the brass so that it will flow over the saw before taking it off the fire, and cool very slow so as not to make the braze brittle. File off what remains on the saw, and it is ready for use.

TO REMOVE RUST.—If you immerse the articles in kerosene oil and let them remain for some time, the rust will become so much loosened as to come off very easy.

TO SOLDER FERRULES FOR TOOL HANDLES.—Take your ferrule, lap round the jointing a small piece of brass wire, then just wet the ferrule, scatter on the joining ground borax, put it on the end of a wire, and hold it in the fire till the brass fuses. It will fill up the jointing, and form a perfect solder. It may afterwards be turned in the lathe.

HARDENING WOOD FOR PULLEYS.—After a wooden pulley is turned and rubbed smooth, boil it for about eight minutes in olive oil; then allow it to dry, and it will become almost as hard as copper.

TO PURIFY GAS.—The purifier is to be filled with milk of lime, made by mixing 1 part of slaked lime with 25 parts of water. A very great improvement in the purification of gas has been effected by Mr. Statter, of England, by the employment of hydrated clay along with the lime employed for this purpose. Hydrated clay unites with the ammonia of the gas as with a base, and, at the same time, with its sulphuret of carbon as an acid, and thus removes both of these noxious impurities from the gas exposed to its influence. It assists also, in conjunction with the lime, in removing tarry vapor and other impurities from the gas. The illuminating power of the gas is positively increased by the clay purification from 22 to 33½ per cent.

TO JOINT LEAD PLATES.—The joints of lead plates for some purposes are made as follows: The edges are brought together, hammered down into a sort of channel cut out of wood, and secured

with a few tacks. The hollow is then scraped clean with a scraper, rubbed over with candle grease, and a stream of hot lead is poured into it, the surface being afterwards smoothed with a red hot plumber's iron.

TO JOINT LEAD PIPES.—Widen out the end of one pipe with a taper wood drift, and scrape it clean inside; scrape the end of the other pipe outside a little tapered, and insert it in the former: then solder it with common lead solder as before described; or, if it requires to be strong, rub a little tallow over, and cover the joint with a ball of melted lead, holding a cloth (2 or 3 plies of greased bed-tick) on the under side; and smoothing over with it and the plumber's iron.

TINNING INTERIOR OF LEAD PIPES.—This invention consists in applying a flux of grease or muriate of zinc or any other flux that will protect the lead from oxidation, and insure a perfect coating of tin, when the tin is poured through the pipe or the pipe dipped into the bath of tin; after the lead pipe has been made, place the same in a vertical or nearly vertical position, and pass down through the same a strong cord, to which a weight is attached to draw the cord through the pipe; and at or near the other end of the cord a sponge, or piece of other porous or elastic material, is attached, of a size to fill the pipe, and of any desired length, say 6 inches more or less. The sponge or porous wad being saturated with the flux, is drawn through the pipe, and by its length ensures the covering of the entire inside surface of the inside of the pipes with the flux, so that the melted tin, subsequently applied, will adhere to all parts with uniformity and firmness.

TO SOFTEN CAST IRON FOR TURNING.—Steep it in 1 part of aquafortis to 4 of water, and let it remain in 24 hours.

TO BREAK OLD UP CANNON.—Old cannon and massive castings may be cut in two by a continuous stream of hot molten iron, which wears away the iron as a stream of hot water would eat into a mass of ice. Or the gun may be rolled on a frame to the mouth of a furnace, and the muzzle end shoved in as far as possible among other iron, the opening filled up and luted around the gun, the end of which is melted off. At the next charge shove it in another length, and so on until the breech is disposed of.

Large masses of cast iron may be broken up by drilling a hole in the most solid part, filling it with water, fitting a steel plug very accurately into the hole, and letting the drop of a pile driver descend on the plug.

ECONOMIC LUBRICATOR.—India rubber, 4 lbs., dissolved in spirits, turpentine; common soda, 10 lbs.; glue, 1 lb.; water, 10 gal.; oil 10 gal. Dissolve the soda and glue in the water by heat, then add the oil, and lastly the dissolved rubber, mix well by stirring.

TO LESSEN FRICTION IN MACHINERY.—Grind together black lead with 4 times its weight of lard or tallow. Camphor is sometimes added (7 lbs. to the hundredweight).

BEST STEP FOR TURBINE WHEELS.—Swamp or rock maple is a better step than either lignum vite or elm for turbine wheels.

WATER ANNEALING.—Heat the steel to a red heat, and let it lie a few minutes, until nearly black hot; then throw it into soap-suds;

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steel in this way may be annealed softer than by putting it into the ashes of the forge.

TEMPERING LIQUID.—To 7 quarts soft water, put in corrosive sublimate, $1\frac{1}{2}$ oz.; common salt, 2 handfuls; when dissolved, it is ready for use. The first gives toughness to the steel, while the latter gives the hardness. Be careful with this preparation, as it is a dangerous poison.

ANOTHER.—Salt, 1 tea-cup; saltpetre, 1 oz.; alum, pulverized, 2 teaspoons; soft water, 2 gallons; never heat over a cherry red, nor draw any temper.

ANOTHER.—Saltpetre, sal-ammoniac, and alum, of each 4 oz.; salt, 3 lbs.; water, 6 gallons; and draw no temper.

ANOTHER.—Saltpetre and alum, each, 2 oz.; sal-ammoniac, $\frac{1}{2}$ oz.; salt, $1\frac{1}{2}$ lb.; soft water, 2 gallons. Heat to a cherry red, and plunge in, drawing no temper.

ANOTHER.—Water, 2 gal.; saltpetre, $\frac{1}{2}$ oz.; pulverized borax, $\frac{1}{2}$ oz.; sal-ammoniac, $\frac{1}{2}$ oz.; white vitriol, 1 oz.; salt $1\frac{1}{2}$ pt. Do not hammer too cold, nor heat too high. If you follow the directions previously given for tempering mill picks, you will generally come out all right.

RESTORING BURNT STEEL.—It is not generally known that burnt steel may be almost instantaneously restored by plunging it while hot in cold water, and hammering it with light strokes on the anvil, turning it so as to hammer all over it, again dipping in the cold water, and repeating the hammering process as before. Try it; if you don't succeed the first time, you will soon do so. We saw this done by Mr. T. S. Smith, while in Cincinnati, Ohio, and can vouch for the truth of this statement. Mr. Smith stated that it was an accidental discovery of his own.

PARKER'S COPPER HARDENING process is performed by introducing an admixture of a minute quantity of phosphorus into the metal.

FLUX FOR WELDING COPPER.—Boracic acid, 2 parts; phosphate of soda, 1 part; mix. This welding powder should be strewn over the surface of copper at a red heat; the pieces should then be heated up to a full cherry red, or yellow heat, and brought immediately under the hammer. Heat the copper at a flame, or gas jet, where it will not touch charcoal or solid carbon.

TO IMPROVE POOR IRON.—Black oxide of manganese, 1 part; copperas and common salt, 4 parts each; dissolve in soft water, and boil till dry; when cool, pulverize, and mix quite freely with nice welding sand. When you have poor iron which you cannot afford to throw away, heat it, and roll it in this mixture; working for a time, reheating, &c., will soon free it from all impurities, which is the cause of its rottenness. By this process you can make good horse-nails out of common iron.

CASE-HARDENING FOR IRON.—Cast iron may be case-hardened by heating to a red heat, and then rolling it in a composition composed of equal parts of prussiate of potash, sal-ammonia, and saltpetre, all pulverized and thoroughly mixed. This must be got to every part of the surface; then plunged, while yet hot, into a bath containing 2 oz. prussiate of potash, and 4 oz. sal-ammoniac to each gallon of cold water.

TO WELD CAST IRON.—The best way of welding cast iron is to take it at a very intense heat, closely approaching the melting point. In this state it will be found sufficiently malleable to stand the operation of welding by the hammer. There are other methods, but most of them are attended by almost insurmountable difficulties.

HARDENING AND FILLING FOR FIRE-PROOF SAFES.—Experience has shown that the fire and burglar-proof diamond chill for iron or steel, described in another part of this work, has no superior as a hardening for security in the construction of safes; and, as a non-conductor of heat, we would recommend a filling of plaster of Paris or alum. It is claimed by some that a mixture of both of these articles forms the best known filling for safes, as an external application of intense heat is certain to liberate a large quantity of water, which is transformed into steam, thus ensuring entire safety to the contents of the safe. Other manufacturers employ a concrete filling for safes, and extol it very highly. Mr. Moffat, gas and steamfitter, Boston, has informed me that he has applied for protection in the matter of a discovery by which he claims that he can fully protect a safe against a double blast furnace heat, by means of an outside lining of bricks composed of asbestos and kaolin, a very small portion only of the latter material being used. From the well known incombustible nature of these materials, there can be no reasonable doubt but that the claim in question is a just one.

FOR MALLEABLE IRON.—Put the articles in an iron box, and stratify them among animal carbon, that is, pieces of horns, hoofs, skins, or leather, just sufficiently burned to be reduced to powder. Lute the box with equal parts of sand and clay; then place it in the fire, and keep at a light red heat for a length of time proportioned to the depth of steel required, when the contents of the box are emptied into water.

ANOTHER FOR WRIGHT IRON.—Take prussiate of potash, finely pulverized, and roll the article in it, if its shape admits of it; if not, sprinkle the powder upon it freely while the iron is hot.

TO SOFTEN CAST IRON FOR DRILLING.—Heat to a cherry red, letting it lie level in the fire; then with a pair of cold tongs put on a piece of brimstone, a little less in size than the hole will be when drilled, and it softens entirely through the piece; let it lie in the fire until a little cool, when it is ready for drilling.

TO TEMPER SPRINGS.—For tempering cast-steel trap springs, all that is necessary is to heat them in the *dark*, just so that you can see that they are red; then cool them in lukewarm water. You can observe a much lower degree of heat in the dark than by daylight, and the low heat and warm water give the desired temper.

DIPPING TOOLS WHEN HARDENING.—To harden a penknife blade, lancet, razor, chisel, gouge-bit, plane, spoke-shave, iron shaving knife, three and four square files, and round and flat files, dip them endwise or perpendicularly. This keeps them straight, which would not be the case were they dipped in the water obliquely.

CAST IRON ORNAMENTS are rendered susceptible of being finished with a scraper, where they cannot be reached with files, after having the following liquid applied to them.

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SCALING CAST IRON.—Vitriol, 1 part; water, 2 parts; mix and lay on the diluted vitriol with some old cloth in the form of a brush, enough to wet the surface well; after 8 or 10 hours, wash off with water, when the hard, scaly surface will be completely removed.

VARNISH FOR SMOOTH MOULDING PATTERNS.—Alcohol, 1 gal.; shellac, 1 lb.; lamp or ivory black, sufficient to color it.

IRON LUSTRE is obtained by dissolving a piece of zinc with muriatic acid, and mixing the solution with spirit of tar, and applying it to the surface of the iron.

TO MELT STEEL AS EASILY AS LEAD.—This apparent impossibility is performed by heating the bar of iron or steel red hot, and then touching it with a roll of brimstone, when the metal will drop like water. Red hot iron can be easily cut with a saw.

PATENT LUBRICATING OIL.—Water, 1 gal.; clean tallow, 3 lbs.; palm oil, 10 lbs.; common soda, $\frac{1}{2}$ lb. Heat the mixture to about 210° Fahr.; stir well till it cools down to 70° Fahr., when it is fit for use.

BLACK HAVING A POLISH FOR IRON.—Pulverized gum asphaltum, 2 lbs.; gum benzoin, $\frac{1}{2}$ lb.; spirits of turpentine, 1 gal.; to make quick, keep in a warm place, and shake often; shade to suit with finely ground ivory black. Apply with a brush. And it ought to be used on iron exposed to the weather as well as on inside work desiring a nice appearance or polish.

VARNISH FOR IRON.—Asphaltum, 8 lbs.; melt in an iron kettle, slowly adding boiled linseed oil, 5 gals.; litharge, 1 lb.; and sulphate of zinc, $\frac{1}{2}$ lb.; continuing to boil for 3 hours; then add dark gum amber, $1\frac{1}{2}$ lb.; and continue to boil 2 hours longer. When cool, reduce to a proper consistence to apply with a brush, with spirits of turpentine.

TEMPERING MILL PICKS.—Get double refined cast steel made expressly for mill picks. In drawing out the pick, use an anvil and hammer with smooth faces, and be careful not to heat the steel higher than a dark cherry red. Do not strike the pick on the edge when finishing it, but hammer it on the flat side, striking light and often, until the steel is quite dark, letting the blows fall so as to close the pores of the steel. When a dozen picks are ready to temper, get 2 gals. of rain water from which the chill should be taken, if in winter, by dipping a hot iron into it; add 2 lbs. salt, and it is ready for use. Heat your pick gradually from the centre; let the heat run to the point, and when it is a dark cherry red, dip the point vertically into the bath and hold it still. When the heat has left the part immersed, take it out, and cool the balance of the pick in ordinary water. Be sure to heat and hammer well.

WELDING CAST STEEL.—Rock saltpetre, $\frac{1}{2}$ lb.; dissolve in $\frac{1}{2}$ lb. oil vitriol; and add it to 1 gal. water. After scarfing the steel, get it hot; and quench in the preparation. Then weld it the same as a piece of iron, hammer it very quick with light blows. It answers the purpose much better than borax; cork it in a bottle, and it will keep for years.

ANOTHER.—Borax, 15 parts; sal-ammoniac, 2 parts; cyanide of potassium, 2 parts; dissolve all in water, and evaporate the water at a low temperature.

CASE HARDENING COMPOUND.—Prussiate of potash, 3 lbs.; sal-ammoniac, 2 lbs.; bone dust, 2 lbs.

ANOTHER.—Pulverized borax any quantity, and slightly color it with dragon's blood. Heat the steel red hot, shake the borax over it; place it again in the fire till the borax smokes on the steel, which will be much below the ordinary welding heat, and then hammer it.

CEMENT TO RESIST RED HEAT AND BOILING WATER.—To 4 or 5 parts of clay, thoroughly dried and pulverized, add 2 parts of fine iron filings free from oxide, 1 part of peroxyde of manganese, 1 part of common salt, and $\frac{1}{2}$ part of borax. Mingle thoroughly, render as fine as possible, then reduce to a thick paste with the necessary quantity of water, mixing well; use immediately, and apply heat, gradually increasing almost to a white heat.

CEMENT TO JOIN SECTIONS OF CAST-IRON WHEELS, &C.—Make a paste of pure oxide of lead, litharge, and concentrated glycerine. Unrivalled for fastening stone to stone or iron to iron.

VARNISH FOR BOILERS.—Asphaltum dissolved in turpentine.

SOFT CEMENT FOR STEAM-BOILERS, STEAM-PIPES, &C.—Red or white lead, in oil, 4 parts; iron borings, 2 to 3 parts.

HARD CEMENT.—Iron borings and salt water, and a small quantity of sal-ammoniac, with fresh water.

METAL POLISH.—Rotten-stone, followed by Paris white and rouge.

GASFITTERS' CEMENT.—Mix together resin, 4 $\frac{1}{2}$ parts; wax, 1 part; and Venetian red, 3 parts.

PLUMBERS' CEMENT.—Black resin, 1 part; brick dust, 2 parts, well incorporated by a melting heat.

COPPERSMITHS' CEMENT.—Boiled linseed oil and red lead mixed together into a putty, are often used by coppersmiths and engineers to secure joints; the washers of leather or cloth are smeared with this mixture in a pasty state.

COMPOSITIONS TO FILL HOLES IN CASTINGS.—Mix 1 part of borax in solution with 4 parts dry clay. *Another:* Pulverized binoxide of manganese, mixed with a strong solution of silicate of soda (water clay) to form a thick paste.

CAST IRON CEMENT.—Clean borings, or turnings of cast iron, 16 parts; sal-ammoniac, 2 parts; flour of sulphur, 1 part; mix them well together in a mortar, and keep them dry. When required for use, take of the mixture, 1 part; clean borings, 20 parts; mix thoroughly, and add a sufficient quantity of water. A little grindstone dust added improves the cement.

CEMENT FOR STEAM-PIPE JOINTS, ETC., WITH FACED FLANGES.—White lead, mixed, 2 parts; red lead, dry, 1 part; grind, or otherwise mix them to a consistence of thin putty; apply interposed layers with 1 or 2 thicknesses of canvas, or gauze wire, as the necessity of the case may be.

CEMENT FOR JOINTS OF IRON PIPES OR HOLES IN CASTINGS.—Take of iron borings, coarsely powdered, 5 lbs.; of powdered sal-ammoniac, 2 oz.; of sulphur, 1 oz., and water sufficient to moisten it. This composition hardens rapidly, but, if time can be allowed, it sets more firmly without the sulphur. Use as soon as mixed, and ram tightly into the joints or holes.

CEMENT TO MEND LEAKY BOILERS.—Powdered litharge, 2 parts, very fine sand, 2 parts, slacked quick lime, 1 part. Mix all together. To use, mix the proper quantity with boiled linseed oil and apply quick. It gets hard very soon.

FIRE CEMENT.—Fire clay, wet, 100 parts, white lead, 3 parts, powdered asbestos, $\frac{1}{2}$ part, mix all together and use as mortar.

STRONG CEMENT FOR STEAM JOINTS.—White lead ground in oil, 10 parts, black oxide of manganese, 3 parts, litharge, 1 part. Reduce to the proper consistency with boiled linseed oil and apply.

CEMENT FOR HOLES OR CRACKS.—Red lead ground in oil, 6 parts, white lead, 3 parts, oxide of manganese, 2 parts, silicate of soda, 1 part, litharge, $\frac{1}{2}$ part, all mixed and used as putty.

TO TEMPER IRON OR STEEL VERY HARD.—Pulverize and dissolve the following articles in 1 qt. hot water: blue vitriol, 1 oz., borax, 1 oz., prussiate of potash 1 oz., charcoal, 1 oz., salt, $\frac{1}{2}$ pt., then add 1 gal. linseed oil, mix well, bring your iron or steel to the proper heat and cool in the solution. It is said the manufacturers of the Judson governor paid \$100 for this receipt, the object being to case harden iron so that it would take a bright polish like steel.

RAILWAY TRAIN SPEED TABLE.—A train going 1 mile an hour travels one and seven-fifteenths—say one and a half foot per second. To form a table of speed from these data is a mere matter of multiplication. Example:—A train going 70 miles an hour travels per second 1 and 7-15 ft. multiplied by 70=102 and two thirds feet.

GERMAN WELDING POWDER.—Iron turnings, 4 parts; borax, 3 parts, borate of iron, 2 parts; water, 1 part.

TEMPERING SWORDS AND CUTLASSES.—N. P. Amès, late of Chicopee, Mass., after many costly experiments, found that the most successful means of tempering swords and cutlasses that would stand the U. S. Government test, was by heating in a charcoal fire, hardening in pure spring water, and drawing the temper in charcoal flame.

MOXON'S CASE-HARDENING PROCESS.—Cow's horns or hoofs are to be baked, dried and pulverized in order that more may be got into the box with the articles, or bone dust answers very well. To this add an equal quantity of bay salt; mix them with stale chamber lye, or white wine vinegar; cover the iron with this mixture, and bed it in the same in loam, or enclose it in an iron box, lay it on the hearth of the forge to dry and harden; then put it into the fire, and blow till the lump has a blood red heat, and no higher, lest the iron mixture be burnt too much. Take the iron out and throw it into cold water.

TURNING AND BORING.—For *turning*, the proper speed for the circumference is about fifteen feet per minute. The best speed for boring cast iron is about $7\frac{1}{2}$ feet per minute. For *drilling*, about 10 or 11 feet per minute is a good speed for the circumference of the tool. For a 1 inch drill, 40 revolutions = 11 feet per minute, other sizes in proportion.

HOW TO FIT KEYS INTO LOCKS.—When it is not convenient to take locks apart in the event of keys being lost, stolen, or missing, when you wish to fit a new key, take a lighted match or candle and smoke the new key in the flame, introduce it carefully into the

key-hole, press it firmly against the opposing wards of the lock, withdraw it, and the indentations in the smoked part of the key will show you exactly where to file.

METAL FOR MODELS.—Tea lead, 6 lbs.; tin, $\frac{1}{2}$ lb.; antimony, $\frac{3}{4}$ lb.

ALLOYS FOR DENTISTS' MOULDS AND DIES.—1. *Tin, very hard.* Tin, 16 parts; antimony, 1 part; zinc, 1 part. 2. *Copper alloy, very hard.* Tin, 12 parts; antimony, 2 parts; copper, 1 part. 3. *Tin, softer than No. 1.* Tin, 8 parts; zinc, 1 part; antimony, 1 part. 4. *Cadmium alloy about the hardness of zinc.* Tin, 10 parts; antimony, 1 part; cadmium, 1 part.

FLUX FOR REDUCING LEAD ORE.—Red argol, 8 parts; nitre, 4 parts; borax, 2 parts; fluorspar, 1 part; grind well, and mix thoroughly.

GRAHAM'S QUICK BRONZING LIQUIDS.—For immediate action on Copper, Brass, or Zinc. 1. *Brown or Dark Bronze for Copper, Brass or Zinc.*—Dissolve 5 drachms nitrate of iron in 1 pt. water; or, 5 drs. perchloride of iron in 1 pt. water. A black may also be obtained from 10 ozs. muriate of arsenic in 2 pts. permuriate of iron, and 1 pt. water. 2. *Brown or Red Bronzing for Brass.* Dissolve 16 drs. nitrate of iron, and 16 drs. hyposulphate of soda, in 1 pt. water, or, 1 dr. nitric acid may be substituted for the nitrate of iron. 3. *Red Brown Bronzing for Brass.* Dissolve 1 oz. nitrate of copper, and 1 oz. oxalic acid in 1 pt. water, brought to the boil and then cooled. 4. *Dark Brown Bronzing for Brass.* Mix 1 oz. cyanide of potassium, and 4 drs. nitric acid, with 1 pt. water. 5. *Red Bronzing for Brass.* Mix 30 grs. tersulphite of arsenic, 6 drs. solution of pearlash, and 1 pt. water. 6. *Orange Bronzing on Brass.* Mix 1 dr. potash solution of sulphur with 1 pt. water. 7. *Olive Green Bronze for Brass.* Dissolve 1 pt. permuriate of iron in 2 pts. water. 8. *Slate-coloured Bronzing for Brass.* Dissolve 2 drs. sulphocyanide of potassium, and 5 drs. perchloride of iron, in 1 pt. water. 9. *Steel Grey Bronzing for Brass.* Mix 1 oz. muriate of arsenic with 1 pt. water, and use at a heat not less than 180° Fahr. 10. *Bright Red Bronzing for Copper.* Mix 2 drs. sulphide of antimony, and 1 oz. pearlash in 1 pt. water. 11. *Dark Red Bronze for Copper.* Dissolve 1 dr. sulphur and 1 oz. pearlash in 1 pt. water. 12. *Copper Colored Bronzing for Zinc.* Agitate the articles in a solution of 8 drs. sulphate of copper, and 8 drs. hyposulphate of soda in 1 pt. water.

SILVER WHITE BRONZE POWDER.—Melt together 1 oz. each bismuth and tin, then add 1 oz. quicksilver, cool and powder.

GOLD COLORED BRONZE POWDER.—Verdigris, 8 ozs.; tutty powder, 4 ozs.; borax and nitre, each 2 ozs.; bichloride of mercury, $\frac{1}{2}$ oz.; make into a paste with oil, and fuse them together. Used in japaning as a gold color.

TO CONSTRUCT A METRONOME.—Take a cheap clock movement and substitute for the pendulum a wire with a sliding weight, marking the wire with a file at the different points of graduation. Used to indicate the proper time in music.

TO MAKE DUALIN.—Dualin is made from paper stock, saturated with nitrate of potassium and dried in a furnace, then ground and mixed with nitro-glycerine. Component parts of Nitro-glycerine. To 4½ lbs. of concentrated sulphuric acid and 2½ lbs. of concentrated nitric acid, add 1 lb. of glycerine.

BLACK VARNISH FOR COAL BUCKETS.—Asphaltum, 1 lb.; lamp-black, $\frac{1}{2}$ lb.; resin, $\frac{1}{2}$ lb.; spirits of turpentine, 1 qt. Dissolve the asphaltum and resin in the turpentine, then rub up the lamp-black with linseed oil, only sufficient to form a paste, and mix with the others. Apply with a brush.

SOLDERING FLUID.—Take 2 oz. muriatic acid; add zinc till bubbles cease to rise; add $\frac{1}{2}$ teaspoonful of sal-ammoniac.

JAPAN FLOW FOR TIN.—ALL COLORS.—Gum sandarach, 1 lb.; balsam of fir, balsam of tolu, and acetate of lead, of each, 2 oz.; linseed oil, $\frac{1}{2}$ pint; spirits of turpentine, 2 qts. Put all into a suitable kettle, except the turpentine, over a slow fire at first; then raise to a higher heat till all are melted; now take from the fire, and, when a little cool, stir in the spirits of turpentine, and strain through a fine cloth. This is transparent; but by the following modifications, any or all of the various colors are made from it:

2. **BLACK.**—Prussian blue, 1 oz.; asphaltum, 2 oz.; spirits of turpentine, $\frac{1}{2}$ pint. Melt the asphaltum in the turpentine; rub up the blue with a little of it; mix well, and strain; then add the whole to 1 pint of the *first*, above.

3. **BLUE.**—Indigo and Prussian blue, both finely pulverized, of each $\frac{1}{2}$ oz.; spirits of turpentine, 1 pint. Mix well, and strain. Add of this to 1 pint of the *first* until the colors suits.

4. **RED.**—Take spirits of turpentine, $\frac{1}{2}$ pt.; add cochineal, $\frac{1}{2}$ oz.; let stand 15 hours and strain. Add of this to the *first* to suit the fancy. If carmine is used instead of cochineal, it will make a fine color for watch hands.

5. **YELLOW.**—Take 1 oz. of pulverized root of curcuma, and stir of it into 1 pt. of the *first* until the color pleases you; let stand a few hours, and strain.

6. **GREEN.**—Mix equal parts of the blue and yellow together, then mix with the *first* until it suits the fancy.

7. **ORANGE.**—Mix a little of the red with more of the yellow, and then with the *first* as heretofore, until pleased.

8. **PINK.**—Mix a little of the blue to more in quantity of the red, and then with the *first* until suited. Apply with a brush.

TRANSPARENT BLUE FOR IRON OR STEEL.—Demar varnish, $\frac{1}{2}$ gal.; fine ground Prussian blue, $\frac{1}{2}$ oz.; mix thoroughly. Makes a splendid appearance. Excellent for bluing watch-hands.

TO TIN COPPER STEW DISHES, &C.—Wash the surface of the article to be tinned with sulphuric acid, and rub the surface well, so as to have it smooth and free of blackness caused by the acid; then sprinkle calcined and finely pulverized sal-ammoniac upon the surface, holding it over a fire, when it will be sufficiently hot to melt a bar of solder which is to be rubbed over the surface. Any copper dish or vessel may be tinned in this way.

TO COPPER THE SURFACE OF IRON, STEEL, OR IRON WIRE.—Have the article perfectly clean, then wash with the following solution, and it presents at once a coppered surface. Rain water, 3 lbs.; sulphate of copper, 1 lb.

BLACK BRONZE ON IRON OR STEEL.—The following mixtures are employed: liquid No. 1. A mixture of bichloride of mercury and sal-ammoniac. No. 2. A mixture of perchloride of iron, sulphate

of copper, nitric acid, alcohol and water. No 3. Perchloride and protochloride of mercury mixed with nitric acid, alcohol and water. No. 4. A weak solution of sulphide of potassium. Clean your metal well and apply a slight coat of No. 1 with a sponge; when quite dry, apply another coat. Remove the resulting crust of oxide with a wire brush, rub the metal with a clean rag, and repeat this operation after each application of these liquids. Now apply several coats of No. 2, and also of No. 3, with a full sponge; then, after drying for ten minutes, throw the pieces of metal into water heated near the boiling point; let them remain in the water from 5 to 10 minutes according to their size. After being cleaned, cover again with several coatings of No. 3, afterwards with a strong coating of No. 4; then again immerse in the bath of hot water. Remove from the bath, dry, and wipe the pieces with carded cotton dipped in liquid No. 3, diluted each time with an increased quantity of water; then rub and wipe them with a little olive oil; again immerse in a water bath heated to 140° Fahr., remove them, rub briskly with a woollen rag, and lastly, with oil. Unequalled for producing a beautiful glossy black on gun-barrels, steel, iron, &c.

TINNING SMALL ARTICLES.—Dissolve as much zinc scraps in muriatic acid as it will take up, let it settle, then decant the clear, and it is ready for use. Next prepare a suitable iron vessel, set it over the fire, put your tin therein, and melt it, and put as much mutton or beef tallow as will cover the tin about $\frac{1}{4}$ inch thick. This prevents the oxidation of the metal; but be very careful that the tallow does not catch fire. The iron, or any other metal to be tinned, must be *well cleaned*, either with scraping, filing, polishing with sand, or immersion in diluted vitriol. Proceed to wet the articles in the zinc solution, then carefully immerse them in the tallow and melted tin; in a very short time they will be perfectly tinned, when they may be taken out.

GOLD LACQUER FOR TIN.—TRANSPARENT, ALL COLORS.—Alcohol in a flask, $\frac{1}{2}$ pt.; add gum shellac, 1 oz; turmeric, $\frac{1}{2}$ oz.; red sanders, $\frac{1}{2}$ oz. Set the flask in a warm place, shake frequently for 12 hours or more, then strain off the liquor, rinse the bottle, and return it, corking tightly for use.

When this varnish is used, it must be applied to the work freely and flowing, and the articles should be hot when applied. One or more coats may be laid on, as the color is required more or less light or deep. If any of it should become thick from evaporation, at any time, thin it with alcohol. And by the following modifications, all the various colors are obtained:

2. **ROSE COLOR.**—Proceed as above, substituting $\frac{1}{4}$ oz. of finely ground best lake in place of the turmeric.

3. **BLUE.**—The blue is made by substituting pulverized Prussian blue, $\frac{1}{2}$ oz., in place of the turmeric.

4. **PURPLE.**—Add a little of the blue to the *first*.

5. **GREEN.**—Add a little of the rose-color to the *first*.

CRYSTALLIZED TIN-PLATE.—The figures are more or less beautiful and diversified, according to the degree of heat and relative dilution of the acid. Place the tin-plate, slightly heated, over a tub of water, and rub its surface with a sponge dipped in a liquor

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composed of 4 parts of aquafortis and 2 of distilled water, holding 1 part of common salt or sal-ammoniac in solution. Whenever the crystalline spangles seem to be thoroughly brought out, the plate must be immersed in water, washed either with a feather or a little cotton (taking care not to rub off the film of tin that forms the feathering), forthwith dried with a low heat, and coated with a lacquer varnish, otherwise it loses its lustre in the air. If the whole surface is not plunged at once in cold water, but if it be partially cooled by sprinkling water on it, the crystallization will be finely variegated with large and small figures. Similar results will be obtained by blowing cold air through a pipe on the tinned surface, while it is just passing from the fused to the solid state.

TO CRYSTALLIZE TIN.—Sulphuric acid, 4 oz.; soft water, 2 to 3 oz., according to strength of the acid; salt, 1½ oz. Mix. Heat the tin hot over a stove, then, with a sponge apply the mixture, then wash off directly with clean water. Dry the tin, and varnish with demar varnish.

TO CLEAN AND POLISH BRASS.—Oil of vitriol, 1 oz.; sweet oil, ½ gill; pulverized rotten stone, 1 gill; rain water, 1½ pts. Mix all, and shake as used. Apply with a rag, and polish with buckskin or old woollen.

SILVERING POWDER.—Nitrate of silver and common salt, of each, 30 grs.; cream of tartar, 3½ drs. Pulverize finely, mix thoroughly, and bottle for use. Unequalled for polishing copper and plated goods.

TIN CANS.—SIZE OF SHEET, FOR FROM 1 TO 100 GALLONS.					
For 1 gallon,	7 by 20 inches.	For 25 gallons,	30 by 56 inches.		
3½ "	10 by 28 "	40 "	36 by 63 "		
5 "	12 by 40 "	50 "	40 by 70 "		
6 "	14 by 40 "	75 "	40 by 84 "		
10 "	20 by 42 "	100 "	40 by 98 "		
15 "	30 by 42 "				

This includes all the laps, seams, &c., which will be found sufficiently correct for all practical purposes.

TINNING IRON.—Cleanse the metal to be tinned, and rub with a coarse cloth, previously dipped in hydrochloric acid (muriatic acid), and then rub on French putty with the same cloth. French putty is made by mixing tin filings with mercury.

TINNING.—1. Plates or vessels of brass or copper boiled with a solution of stannate of potassa, mixed with turnings of tin, become, in the course of a few minutes, covered with a firmly attached layer of pure tin. 2. A similar effect is produced by boiling the articles with tin filings and caustic alkali, or cream of tartar. In the above way, chemical vessels made of copper or brass may be easily and perfectly tinned.

NEW TINNING PROCESS.—Articles to be tinned are first covered with dilute sulphuric acid, and, when quite clean, are placed in warm water, then dipped in a solution of muriatic acid, copper, and zinc, and then plunged into a tin bath to which a small quantity of zinc has been added. When the tinning is finished, the articles are taken out, and plunged into boiling water. The operation is completed by placing them in a very warm sand-bath. This last process softens the iron.

KUSTITIEN'S METAL FOR TINNING.—Malleable iron, 1 lb. beat to whiteness; add 5 oz. regulus of antimony, and Mollucca tin, 24 lbs.

GALVANIZING IRON.—The iron plates are first immersed in a cleansing bath of equal parts of sulphuric or muriatic acid and water used warm; they are then scrubbed with emery or sand, to clean them thoroughly and detach all scales if any are left, after which they are immersed in a "preparing bath" of equal parts of saturated solutions of chloride of zinc and chloride of ammonium, from which bath they are directly transferred to the fluid "metallic bath," consisting, by weight, of 340 lbs. zinc to 106 lbs. of mercury, to which are added from 5 to 6 oz. of sodium. As soon as the iron has attained the temperature of this hot fluid bath, which is 680° Fahr., it may be removed, and will then be found thoroughly coated with zinc. A little tallow on the surface of the metallic bath will prevent oxidation.

PASTE FOR CLEANING METALS.—Take oxalic acid, 1 part; rottenstone, 6 parts; mix, with equal parts of train oil and spirits of turpentine, to a paste.

TO PREVENT IRON OR STEEL FROM RUSTING.—Warm your iron or steel till you cannot bear your hand on it without burning yourself, then rub it with new and clean white wax. Put it again to the fire till it has soaked in the wax. When done, rub it over with a piece of serge. This prevents the metal from rusting afterwards.

BRONZING LIQUIDS FOR TIN CASTINGS.—Wash them over, after being well cleaned and wiped, with a solution of 1 part of sulphate of iron and 1 of sulphate of copper, in 20 parts of water; afterwards, with a solution of 4 parts verdigris in 11 of distilled vinegar; leave for an hour to dry and then polish with a soft brush and colcothar.

FANCY COLORS ON METALS.—1. Dissolve 4 oz. hypo-sulphite of soda in 1½ pts. of water, and then add a solution of 1 oz. acetate of soda in 1 oz. of water. Articles to be colored are placed in the mixture, which is then gradually heated to the boiling point. This will give iron the color of blue steel, zinc becomes bronze, and copper or brass becomes, successively, yellowish, red, scarlet, deep blue, light blue, bluish white, and finally white, with a tinge of rose. 2. By replacing the acetate of lead in the solution by sulphate of copper, brass becomes, first, of a fine rosy tint, then green and lastly, of an iridescent brown color.

COATING IRON CASTINGS WITH GOLD OR SILVER.—The articles to be gilded are well cleaned and boiled in a porcelain vessel, together with 12 parts of mercury, 1 of zinc, 2 of iron vitriol, 1½ of muriatic acid of 1.2 specific gravity, and 12 parts of water; in a short time a layer of mercury will deposit upon the iron, and upon this the gold amalgam may be uniformly distributed. Iron to be silvered is first provided with a coating of copper, upon which the silver is applied either by means of amalgam or silver leaf.

BRUNSWICK BLACK FOR GRATES, &c.—Asphaltum, 5 lbs.; melt, and add boiled oil, 2 lbs.; spirits of turpentine, 1 gal. Mix.

BRONZE PAINT FOR IRON.—Ivory black, 1 oz.; chrome yellow, 1 oz.; chrome green, 2 lbs.; mix with raw linseed oil, adding a little japan to dry it, and you have a very nice bronze green. If desired, gold bronze may be put on the prominent parts, as on the

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tips or edges of an iron railing, when the paint is not quite dry, using a piece of velvet or plush to rub on the bronze.

BLUING ON REVOLVERS AND GUN BARRELS is performed by simply heating the piece to be blued in powdered charcoal over a fire until the desired color is obtained.

BROWNING FOR GUN BARRELS.—Spirits of nitre, 1 lb.; alcohol, 1 lb.; corrosive sublimate, 1 oz.; mix in a bottle, and cork for use. Directions: polish the barrel perfect; then rub it with quick lime with a cloth, which removes grease and dirt; now apply the browning fluid with a clean white cloth, apply one coat, and set it in a warm dark place for from 10 to 20 hours, until a red rust forms on it; then card it down with a gunmaker's card, and rub off with a clean cloth. Repeat the process if you wish a dark shade.

BROWNING FOR TWIST BARRELS.—Spirits of nitre, $\frac{3}{4}$ oz.; tincture of steel, $\frac{3}{4}$ oz.; or use the unmedicated tincture of iron if the tincture of steel cannot be obtained; black brimstone, $\frac{1}{4}$ oz.; blue vitriol, $\frac{1}{4}$ oz.; corrosive sublimate, $\frac{1}{4}$ oz.; nitric acid, 1 dram; copperas, $\frac{1}{4}$ oz.; mix with $1\frac{1}{2}$ pints rain water, and bottle for use. This is to be applied the same as the first; it causes the twist of the barrel to be visible after application, a quality which the other liquid does not possess.

BROWNING COMPOSITIONS FOR GUN BARRELS.—1. Blue vitriol, 4 oz.; tincture of muriate of iron, 2 oz.; water, 1 qt.; dissolve, and add aquafortis and sweet spirits of nitre, of each, 1 oz. 2. Blue vitriol and sweet spirits of nitre, of each 1 oz.; aquafortis, $\frac{1}{4}$ oz.; water, 1 pint. To be used in the same manner as previously described in this work.

VARNISH AND POLISH FOR GUN STOCKS.—Gum shellac, 10 oz.; gum sandarach, 1 oz.; Venice turpentine, 1 dr.; 98 per cent. alcohol, 1 gal.; shake the jug occasionally for a day or two, and it is ready for use. Apply a few coats of this to your gun stocks, polish by rubbing smooth, and your work is complete.

BRASS FOR HEAVY CASTINGS.—Copper, 6 to 7 parts; tin, 1 part; zinc, 1 part.

YELLOW BRASS (for casting).—1. Copper, 61.6 parts; zinc, 35.3 parts; lead, 2.9 parts; tin, 0.2 parts. 2. *Brass of Jemappes.*—Copper, 64.6 parts; zinc, 33.7 parts; lead, 1.4 parts; tin, 0.2 parts. 3. *Sheet Brass of Stolberg, near Aix la Chapelle.*—Copper, 64.8 parts; zinc, 32.8 parts; lead, 2.0 parts; tin, 0.4 parts. 4. *D'Arcets Brass for Gilding.*—Copper, 63.70 parts; zinc, 33.55 parts; lead, 0.25 parts; tin, 2.50 parts. 5. *Another.*—Copper, 64.45 parts; zinc, 32.42 parts; lead, 2.86 parts; tin, 0.25 parts. 6. *Sheet Brass of Romilly.*—Copper, 70.1 parts; zinc, 29.9 parts. 7. *English Brass Wire.*—Copper, 70.29 parts; zinc, 29.26 parts; lead, 0.28 parts; tin, 0.17 parts. 8. *Augsburg Brass Wire.*—Copper, 71.89 parts; zinc, 27.63 parts; tin, 0.85 parts.

RED BRASS, FOR GILT ARTICLES.—1. Copper, 82.0 parts; zinc, 18.0 parts; lead, 1.5 parts; tin, 3.0 parts. 2. *Another.*—Copper, 82 parts; zinc, 18 parts; lead, 2 parts; tin, 1 part. 3. *Another.*—Copper, 82.3 parts; zinc, 17.5 parts; tin, 0.2 parts. 4. *French Tombac for Sword Handles.*—Copper, 80 parts; zinc, 17 parts; tin, 2 parts. 5. *For Parisian Ornaments.*—Copper, 85 parts; zinc, 15 parts; tin, a trace. 6. *Used for German Ornaments.*—Copper, 85.3

parts, zinc, 14.7 parts. 7. *Chrysochalk*.—Copper, 90.0 parts; zinc, 7.9 parts; lead, 1.6 parts. 8. *Red Tombac from Paris*.—Copper, 92 parts; zinc, 8 parts.

COMPOSITIONS.—1. *For strong pumps, &c.*—Copper, 1 lb.; zinc, $\frac{1}{2}$ oz.; tin, $1\frac{1}{2}$ oz. 2. *For toothed wheels*.—Copper, 1 lb.; brass, 2 oz.; tin, 2 oz. 3. Copper, 1 lb.; brass, 2 oz.; tin, $1\frac{1}{2}$ oz. 4. *For turning work*.—Copper, 1 lb.; brass, $1\frac{1}{2}$ oz.; tin, 2 oz. 5. *For nuts of coarse threads and bearings*.—Copper, 1 lb.; brass, $1\frac{1}{2}$ oz.; tin, $2\frac{1}{2}$ oz. 6. *For bearings to sustain great weights*.—Copper, 1 lb.; zinc, $\frac{1}{2}$ oz.; tin, $2\frac{1}{2}$ oz. 7. *Pewterers' temper*.—Tin, 2 lbs.; copper, 1 lb. Used to add in small quantities to tin. 8. *Hard bearings for machinery*.—Copper, 1 lb.; tin, 2 oz. 9. *Very hard ditto*.—Copper, 1 lb.; tin, $2\frac{1}{2}$ oz.

ANTI-FRICTION METAL.—1. Copper, 4 lbs.; regulus of antimony, 8 lbs.; Banca tin, 96 lbs. 2. Grain zinc, $7\frac{1}{2}$ lbs.; purified zinc, $7\frac{1}{2}$ lbs.; antimony, 1 lb. 3. Zinc, 17 parts; copper, 1 part; antimony, $1\frac{1}{2}$ parts. This possesses unsurpassable anti-friction qualities, and does not require the protection of outer casings of a harder metal. 4. Block tin, 8 lbs.; antimony, 2 lbs.; copper, 1 lb. If the metal be too hard, it may be softened by adding some lead. 5. The best alloy for journal boxes is composed of copper, 24 lbs.; tin, 24 lbs.; and antimony, 8 lbs. Melt the copper first, then add the tin, and lastly the antimony. It should be first run into ingots, then melted, and cast in the form required for the boxes. 6. Melt in a crucible $1\frac{1}{2}$ lbs. of copper, and, while the copper is melting melt in a ladle 25 lbs. of tin and 3 of antimony, nearly red hot, pour the two together, and stir until nearly cool. This makes the finest kind of lining metal. 7. *Very cheap*. Lead, 100 lbs.; antimony, 15 lbs. This costs about 10 cents per lb.

YELLOW BRASS FOR TURNING.—(Common article.)—Copper, 20 lbs.; zinc, 10 lbs.; lead, 4 oz.

RED BRASS, FREE, FOR TURNING.—Copper, 160 lbs.; zinc, 50 lbs.; lead, 10 lbs.; antimony, 44 oz.

ANOTHER BRASS FOR TURNING.—Copper, 32 lbs.; zinc, 10 lbs.; lead, 1 lb.

BEST RED BRASS, FOR FINE CASTINGS.—Copper, 24 lbs.; zinc, 5 lbs.; bismuth, 1 oz. Put in the bismuth last before pouring off.

BRONZE METAL.—Copper, 7 lbs.; zinc, 3 lbs.; tin, 2 lbs.

BRONZE METAL.—Copper, 1 lb.; zinc, 12 lbs.; tin, 8 lbs.

BELL METAL, FOR LARGE BELLS.—Copper, 100 lbs.; tin, from 20 to 25 lbs.

BELL METAL FOR SMALL BELLS.—Copper, 3 lbs.; tin, 1 lb.

COCK METAL.—Copper, 20 lbs.; lead, 8 lbs.; litharge, 1 oz.; antimony, 3 oz.

HARDENING FOR BRITANNIA.—(To be mixed separately from the other ingredients.)—Copper, 2 lbs.; tin, 1 lb.

GOOD BRITANNIA METAL.—Tin, 150 lbs.; copper, 3 lbs.; antimony, 10 lbs.

BRITANNIA METAL, 2d QUALITY.—Tin, 140 lbs.; copper, 3 lbs.; antimony, 9 lbs.

BRITANNIA METAL, FOR CASTING.—Tin, 210 lbs.; copper, 4 lbs.; antimony, 12 lbs.

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BRITANNIA METAL, FOR SPINNING.—Tin, 100 lbs.; Britannia hardening, 4 lbs.; antimony, 4 lbs.

WHITE SOLDER, FOR RAISED BRITANNIA WARE.—Tin, 100 lbs.; copper, 3 oz., to make it free; and lead, 3 oz.

BRITANNIA METAL, FOR REGISTERS.—Tin, 100 lbs.; hardening, 8 lbs.; antimony, 8 lbs.

BEST BRITANNIA FOR SPOUTS.—Tin, 140 lbs.; copper, 3 lbs.; antimony, 6 lbs.

BEST BRITANNIA FOR SPOONS.—Tin, 100 lbs.; hardening, 5 lbs.; antimony, 10 lbs.

BEST BRITANNIA FOR HANDLES.—Tin, 140 lbs.; copper, 2 lbs.; antimony, 5 lbs.

BEST BRITANNIA, FOR LAMPS, PILLARS, AND SPOUTS.—Tin, 300 lbs.; copper, 4 lbs.; antimony, 15 lbs.

CASTING.—Tin, 100 lbs.; hardening, 5 lbs.; antimony, 5 lbs.

LINING METAL FOR BOXES OF RAILROAD CARS.—Mix tin, 24 lbs.; copper, 4 lbs.; antimony, 8 lbs.; (for a hardening), then add tin, 72 lbs.

FINE SILVER COLORED METAL.—Tin, 100 lbs.; antimony, 8 lbs.; copper, 4 lbs.; bismuth, 1 lb.

GERMAN SILVER, FIRST QUALITY, FOR CASTING.—Copper, 50 lbs.; zinc, 25 lbs.; nickel, 25 lbs.

GERMAN SILVER, SECOND QUALITY, FOR CASTING.—Copper, 50 lbs.; zinc, 20 lbs.; nickel (best pulverized), 10 lbs.

GERMAN SILVER, FOR ROLLING.—Copper, 60 lbs.; zinc, 20 lbs.; nickel, 25 lbs.

GERMAN SILVER, FOR BELLS, AND OTHER CASTINGS.—Copper, 60 lbs.; zinc, 20 lbs.; nickel, 20 lbs.; lead, 3 lbs.; iron (that of tin plate being best), 2 lbs.

IMITATION OF SILVER.—Tin, 3 oz.; copper, 4 lbs.

PINCHBECK.—Copper, 5 lbs.; zinc, 1 lb.

TOMBAC.—Copper, 16 lbs.; tin, 1 lb.; zinc, 1 lb.

RED TOMBAC.—Copper, 10 lbs.; zinc, 1 lb.

HARD WHITE METAL.—Sheet brass, 32 oz.; lead, 2 oz.; tin, 2 oz.; zinc, 1 oz.

METAL FOR TAKING IMPRESSIONS.—Lead, 3 lbs.; tin, 2 lbs.; bismuth, 5 lbs.

SPANISH TUTANIA.—Iron or steel, 8 oz.; antimony, 16 oz.; nitre, 3 oz. Melt and harden 8 oz. tin with 1 oz. of the above compound.

RIVET METAL.—Copper, 32 oz.; tin, 2 oz.; zinc, 1 oz.

RIVET METAL, FOR HOSE.—Tin, 64 lbs.; copper, 1 lb.

FUSIBLE ALLOY.—(Which melts in boiling water.)—Bismuth, 8 oz.; tin, 3 oz.; lead, 5 oz.

FUSIBLE ALLOY, FOR SILVERING GLASS.—Tin, 6 oz.; lead, 10 oz.; bismuth, 21 oz.; mercury, a small quantity

BEST SOFT SOLDER, FOR CAST BRITANNIA WARE.—Tin, 8 lbs.; lead, 5 lbs.

BRASS SOLDER.—1. Copper, 61.25 parts; zinc, 38.75 parts; 2. (Yellow and easily fusible) copper, 45 parts; zinc, 55 parts; 3. (White) copper, 57.41 parts; tin, 14.60 parts; zinc, 27.99 parts.

SPELTER SOLDER. Equal parts copper and zinc.

SOLDER FOR COPPER.—Copper, 10 lbs.; zinc, 9 lbs.

YELLOW SOLDER, FOR BRASS OR COPPER.—Copper, 32 lbs.; zinc, 29 lbs.; tin, 1 lb.

BLACK SOLDER.—Copper, 2 lbs.; zinc, 3 lbs.; tin, 2 oz.

BLACK SOLDER.—Sheet brass, 20 lbs.; tin, 6 lbs.; zinc, 1 lb.

PEWTERERS' SOFT SOLDERS.—1. Bismuth, 2; lead, 4; tin, 3 parts.

2. Bismuth, 1; lead, 1; tin, 2 parts.

PLUMBERS' SOLDER.—Lead, 3 parts; tin, 1 part.

SOLDER.—For lead, the solder is one part tin, 1 to 2 of lead; for tin, 1 to 2 parts tin to one of lead; for zinc, 1 part tin to 1 to 2 of lead; for pewter, 1 part tin to 1 of lead, and 1 to 2 parts of bismuth.

The surfaces to be joined are made perfectly clean and smooth, and then covered with sal-ammoniac, or resin, or both; the solder is then applied, being melted in, and smoothed over by the soldering iron.

TO SOLDER IRON TO STEEL, OR EITHER TO BRASS.—Tin, 3 parts; copper, 39 parts; zinc, 7½ parts. When applied in a molten state it will firmly unite the metals first named to each other.

COPPERSMITHS' SOLDER.—Tin, 2 parts; lead, 1 part. When the copper is thick, heat it by a naked fire; if thin, use a tinned copper tool. Use muriate or chloride of zinc, or resin, as a flux. The same solder will do for iron, cast iron, or steel; if thick, heat by a naked fire, or immerse in the solder.

COLD BRAZING, WITHOUT A FIRE OR LAMP.—Fulvic acid, ½ oz.; oxymuriatic acid, ¼ oz.; mix in a lead bottle. Put a chalk mark each side where you want to braze. This mixture will keep about 6 months in one bottle.

PLUMBERS' SOLDER.—Bismuth, 1 part; lead, 5 parts; tin, 3 parts is a first class composition.

COLD SOLDERING without fire or lamp.—Bismuth, ¼ oz.; quick-silver, ¼ oz.; block tin filings, 1 oz.; spirits salts, 1 oz., mixed together.

NEW AND BEAUTIFUL ALLOYS.—Copper, 69.8 parts; nickel, 19.8 parts; zinc 5.5 parts; cadmium, 4.7 parts; used for spoons, forks, &c. *Another.* Copper, 89.3 parts; aluminum, 10.5 parts. *Oreide resembling Gold.* Copper, 79.7 parts; zinc, 83.05 parts; nickel, 6.09 parts, with a trace of iron and tin.

CHINESE WHITE COPPER.—Copper, 40.4; nickel, 31.6; zinc, 25.4; and iron, 2.6 parts.

BATH METAL.—Brass, 32 parts; zinc, 9 parts.

SPECULUM METAL.—Copper, 6; tin, 2; and arsenic, 1 part. Or, copper, 7; zinc, 3; and tin, 4 parts.

BRITANNIA METAL.—Brass, 4 parts; tin, 4 parts; when fused, add bismuth, 4; and antimony, 4 parts. This composition is added at discretion to melted tin.

SUPERIOR BELL METAL.—Copper, 100 lbs.; tin, 23 lbs.

ELECTRUM.—Copper, 8; nickel, 4; zinc, 3½ parts. This compound is unsurpassed for ease of workmanship and beauty of appearance.

TINMANS' SOLDER.—Lead, 1; tin, 1 part.

PEWTERERS' SOLDER.—Tin, 2; lead, 1 part.

COMMON PEWTER.—Tin, 4; lead, 1 part.

BEST PEWTER.—Tin, 100; antimony, 17 parts.

QUEEN'S METAL.—Tin, 9; antimony, 1; bismuth, 1; lead, 1 part.

WATCH-MAKERS' BRASS.—Copper, 1 part; zinc, 2 parts.

A METAL THAT EXPANDS IN COOLING.—Lead, 9; antimony, 2; bismuth, 1 part. This metal is very useful in filling small defects in iron castings, &c.

GERMAN BRASS.—Copper, 1 part; zinc, 1 part.

ALBATA METAL.—Nickel, 3 to 4 parts; copper, 20 parts; zinc, 16 parts. Used for plated goods.

BRITISH PLATE.—Nickel, 5 to 6 parts; copper, 20 parts; zinc, 8 to 10 parts. Used for plated goods.

CHANDRY'S HARD ALLOY.—Copper, 1 lb.; zinc, 2½ oz.; tin, 2½ oz. Razors as hard as tempered steel have been made from this alloy.

HARD WHITE METAL FOR BUTTONS.—Brass, 1 lb.; zinc, 2 oz.; tin, 1 oz.

BIRMINGHAM PLATIN.—Copper, 8 parts; zinc, 5 parts.

GERMAN SILVER.—1. Copper, 40.62 parts; zinc, 43.76 parts; nickel, 15.62 parts. 2. Copper, 41.47 parts; zinc, 26.08 parts; nickel, 32.45 parts. 3. Copper, 55.55 parts; zinc, 5.55 parts; nickel, 38.90 parts. 4. Copper, 53.40 parts; zinc, 29.10 parts; nickel, 17.50 parts. 5. (*Alfenide* contains a trace of iron)—Copper, 59.60 parts; zinc, 30.30 parts; nickel, 10.10 parts.

BRITANNIA METAL.—1. Copper 0.30 parts; tin, 89.70 parts; zinc, 0.30 parts; antimony, 9.70 parts. 2. Copper, 1.85 parts; tin, 81.64 parts; antimony, 16.51 parts. 3. Copper, 0.91 parts; tin, 89.97 parts; antimony, 9.12 parts. 4. Tin, 90.00 parts; antimony, 10 parts. 5. Copper, 1.78 parts; tin, 89.30 parts; antimony, 7.14 parts; bismuth, 1.78 parts.

GUN METAL.—Copper, 90 parts; tin, 10 parts.

MELTING POINT OF METALS.—Iron fuses at 2787° Fahr.; gold at 2016°; silver, 1873°; copper, 1996°; zinc, 773°; antimony, 809°; bismuth, 476 to 507°; nickel, 630°; tin, 442°; lead, 334°; mercury volatilizes at 670°.

CHINESE GONG METAL.—Copper, 78.00 parts; tin, 22.00.

ALLOY FOR GUN MOUNTINGS.—Copper, 80 parts; tin, 3; zinc, 17.

WHITE METAL FOR TABLE BELLS.—Copper, 2.06 parts; tin, 97.31 parts; bismuth, 0.63 parts.

CLOCK BELL METAL.—Copper, 75.19 parts, tin, 24.81 parts.

SOCKET METAL FOR LOCOMOTIVE AXLE-TREES.—1. Copper, 86.03; tin, 13.97; 2. (*French*) Copper, 82 parts; tin, 10 parts; zinc, 8 parts; 3. (*Stephenson's*) Copper, 79 parts; tin, 8 parts; zinc, 5 parts; lead, 8 parts; 4. (*Belgian*) Copper, 89.02 parts; tin, 2.44 parts; zinc, 7.76 parts; iron, 0.78 parts; 5. (*English*) Copper, 73.96 parts; tin, 9.49 parts; zinc, 9.03 parts; lead, 7.09 parts; iron, 0.43 parts.

BRASS.—1. Copper, 73 parts; zinc, 27 parts; 2. Copper, 65 parts; zinc, 35 parts; 3. Copper, 70 parts; zinc, 30 parts.

ALLOY FOR MECHANICAL INSTRUMENTS.—Copper, 1 lb.; tin, 1 oz.

MALLEABLE BRASS.—1. Copper, 70.10 parts; zinc, 29.90 parts; 2. (*Superior*) Copper, 60 parts; zinc; 40 parts.

BUTTON MAKERS' METAL.—1. Copper, 43 parts; zinc, 67 parts; 2. Copper, 62.22 parts; tin, 2.78 parts; zinc, 35 parts; 3. Copper, 58.94 parts; tin, 5.28 parts; zinc, 35.78 parts.

METAL FOR SLIDING LEVERS OF LOCOMOTIVES.—1. Copper, 85.25 parts; tin, 12.75 parts; zinc, 2.00 parts; 2. (*Fenton's*) Copper, 5.50 parts; tin, 14.50 parts; zinc, 80 parts.

ALLOY FOR CYLINDERS OF LOCOMOTIVES.—Copper, 88.63 parts; tin, 2.38 parts; zinc, 6.99 parts.

ALLOY FOR STUFFING BOXES OF LOCOMOTIVES.—Copper, 90.06 parts; tin, 3.56 parts; zinc, 6.38 parts.

AMALGAM FOR MIRRORS.—1. Tin, 70 parts; mercury, 30 parts; 2. (*For curved mirrors*) Tin, 80 parts; mercury, 20 parts; 3. Tin, 8.33 parts; lead, 8.34 parts; bismuth, 8.33 parts; mercury, 75 parts; 4. (*For spherical mirrors*) Bismuth, 80 parts; mercury, 26 parts.

REFLECTOR METAL.—1. (*Duppler's*) Zinc, 20 parts; silver, 80 parts; 2. Copper, 66.22 parts; tin, 33.11 parts; arsenic, 0.67 parts; 3. (*Cooper's*) Copper, 57.86 parts; tin, 27.28 parts; zinc, 3.30 parts; arsenic, 1.65 parts; platinum, 9.91 parts; 4. Copper, 64 parts; tin, 32.00 parts; arsenic, 4.00 parts; 5. Copper, 82.18 parts; lead, 9.22 parts; antimony, 8.60 parts; 6. (*Little's*) Copper, 69.01 parts; tin, 30.82 parts; zinc, 2.44 parts; arsenic, 1.83 parts.

METAL FOR GILT WARES.—1. Copper, 78.47 parts; tin, 2.87 parts; zinc, 17.23 parts; lead, 1.43 parts; 2. Copper, 64.43 parts; tin, 0.25 parts; zinc, 32.44 parts; lead, 2.86 parts; 3. Copper, 72.43 parts; tin, 1.87 parts; zinc, 22.75 parts; lead, 2.96 parts; 4. Copper, 70.90 parts; tin, 2.00 parts; zinc, 24.05 parts; lead, 3.05.

SPURIOUS SILVER LEAF.—Tin, 90.09 parts; zinc, 9.91 parts.

SHOT METAL.—1. Lead, 97.06 parts; arsenic, 2.93 parts; 2. Lead, 99.60 parts; arsenic, 0.40 parts.

BISMUTH SOLDER.—Tin, 33.33 parts; lead, 33.33 parts; bismuth 33.34 parts.

GLAZIERS' SOLDER.—Tin, 3 parts; lead, 1 part.

AMALGAM FOR ELECTRICAL MACHINES.—1. Tin, 25 parts; zinc, 25 parts; mercury, 50 parts. 2. Tin, 11.11 parts; zinc, 22.22 parts; mercury, 66.67 parts.

TYPE METAL.—1. *For smallest and most brittle types*.—Lead, 3 parts; antimony, 1 part. 2. *For small, hard, brittle types*.—Lead, 4 parts; antimony, 1 part. 3. *For types of medium size*.—Lead, 5 parts; antimony, 1 part. 4. *For large types*.—Lead, 6 parts; antimony, 1 part. 5. *For largest and softest types*.—Lead, 7 parts; antimony, 1 part. In addition to lead and antimony, type metal also contains 4 to 8 per cent. of tin, and sometimes 1 to 2 per cent. of copper. Stereotype plates are made of lead, 20 parts; antimony, 4 parts; tin, 1 part.

BRASS FOR WIRE.—Copper, 34 parts; calamine, 56 parts; mix.

BRITANNIA METAL.—1. Tin, 82 parts; lead, 18 parts; brass, 5 parts; antimony, 5 parts; mix. 2. Brass, 1 part; antimony, 4 parts; tin, 20 parts; mix. 3. Plate-brass, tin, bismuth, and antimony, of each equal parts. Add this mixture to melted tin until it acquires the proper color and hardness.

BRONZE.—1. Copper, 83 parts; zinc, 11 parts; tin, 4 parts; lead, 2 parts; mix. 2. Copper, 14 parts; melt, and add zinc, 6 parts; tin, 4 parts; mix.

ANCIENT BRONZE.—Copper, 100 parts; lead and tin, each, 7 parts; mix.

ALLOY FOR BRONZE ORNAMENTS.—Copper, 82 parts; zinc, 18 parts; tin, 3 parts; lead, 3 parts; mix.

BEAUTIFUL RED BRONZE POWDER.—Sulphate of copper, 100 parts; carbonate of soda, 60 parts: apply heat until they unite into a mass

; 88.63 parts;
-Copper, 90.06

then cool, and add copper filings, 15 parts. Well mix, and keep them at a white heat for 20 minutes; then cool, powder, wash, and dry.

BRONZING FLUID FOR GUNS.—Nitric acid, sp. gr. 1. 2 parts; nitric ether, alcohol, muriate of iron, each 1 part: mix, then add sulphur of copper, 2 parts, dissolved in water, 10 parts.

CANNON METAL.—Take tin, 10 parts; copper, 90 parts: melt.

STATUARY BRONZE.—1. Copper, 88 parts; tin, 9 parts; zinc, 2 parts; lead, 1 part. 2. Copper, 82½ parts; tin, 5 parts; zinc, 10½ parts; lead, 2 parts. 3. Copper, 90 parts; tin, 9 parts; lead, 1 part.

BRONZE, FOR MEDALS.—Copper, 89 parts; tin, 8 parts; zinc, 3 parts.

BRASS, FOR HEAVY WORK.—Copper, 100 parts; tin, 15 parts. zinc, 15 parts. *Another*.—Copper, 112 parts; tin, 13; zinc, 1.

BRASS, FOR TUBES.—Copper, 2 parts; zinc, 1 part.

ALLOY, FOR CYMBALS.—Copper, 80; tin, 20.

MIRRORS OF REFLECTING TELESCOPES.—Copper, 100; tin, 50.

WHITE ARGENTAN.—Copper, 8 parts; nickel, 3 parts; zinc, 35 parts. This beautiful composition is in imitation of silver.

CHINESE SILVER.—Silver, 2.5; copper, 65.24; zinc, 19.52; cobalt of iron, 0.12; nickel, 13.

TUTENAG.—Copper, 8; nickel, 3; zinc, 5.

PRINTING CHARACTERS.—1. Lead, 4; antimony, 2. 2. For stereo-type plates, lead, 25 parts; antimony, 4 parts; tin, 1 part.

FINE WHITE GERMAN SILVER.—1. *For Castings*. Lead, 3 parts; nickel, 20 parts; zinc, 20 parts; copper, 60 parts: mix. 2. *For Rolling*. Nickel, 5 parts; zinc, 4 parts; copper, 12 parts: mix.

IMITATION PLATINUM.—Melt together 8 parts brass and 5 parts of zinc. This alloy very closely resembles platinum.

IMITATION GOLD.—Platina, 8 parts; silver, 4 parts; copper, 12 parts: melt all together.

IMITATION SILVER.—Block-tin, 100 parts; antimony, 8 parts; bismuth, 1 part; copper, 4 parts: melt all together.

TOMBAC, OR RED BRASS.—Melt together 8 parts of copper and 1 part of zinc.

PARISIAN BELL-METAL.—Copper, 72 parts; tin, 26½ parts; iron, 1½ parts. Used for the bells of small ornamental clocks.

BELL-METAL.—1. Copper, 25 parts; tin, 5 parts: mix. 2. Copper, 79 parts; tin, 26 parts: mix. 3. Copper, 78 parts; tin, 22 parts: mix.

PRINCE'S METAL.—1. Copper, 3 parts; zinc, 1 part. 2. Brass, 8 parts; zinc, 1 part. 3. Zinc and copper, equal parts: mix.

QUEEN'S METAL.—1. Lead, 1 part; bismuth, 1 part; antimony, 1 part; tin, 9 parts: mix. 2. Tin, 9 parts; bismuth, 1 part; lead, 2 parts; antimony, 1 part: mix by melting.

BRASS.—Copper, 3 parts: melt, then add zinc, 1 part.

BUTTON-MAKERS' FINE BRASS.—Brass, 8 parts; zinc, 5 parts.

BUTTON-MAKERS' COMMON BRASS.—Button brass, 6 parts; tin, 1 part; lead, 1 part: mix.

ORGAN PIPES consist of lead alloyed with about half its quantity of tin to harden it. The mottled or crystalline appearance so much admired shows an abundance of tin.

BARON WETTERSTEDTS PATENT SHEATHING for ships consists of lead, with from 2 to 8 per cent of antimony; about 3 per cent. is the usual quantity. The alloy is rolled into sheets.

LEAD SHOT are cast by letting the metal run through a narrow slit into a species of colander at the top of a lofty tower; the metal escapes in drops, which, for the most part, assume the spherical form before they reach the tank of water into which they fall at the foot of the tower, and this prevents their being bruised. They are afterwards riddled or sifted for size, and afterwards churned in a barrel with black lead.

METAL FOR ANATOMICAL INJECTIONS.—Tin, 16.41 parts lead, 9.27 parts; bismuth, 27.81 parts; mercury, 46.41 parts.

YELLOW DIPPING METAL.—Copper, 32 lbs.; 6 to 7 oz. zinc to every lb. of copper.

LEAD PIPES are now manufactured by hydraulic pressure instead of by the old process of drawing out on triblets.

MUNTZ METAL FOR SHIPS.—Best selected copper, 60 parts; best zinc, 40 parts. Melt together in the usual manner, and roll into sheets of suitable thickness. This composition resists oxidation from exposure to sea-water, and prevents the adhesion of barnacles.

ACID BRONZE.—Cobalt, 4 lbs.; pulverize; sift through a fine sieve; put in a stone pot; add $\frac{1}{2}$ gal. nitric acid, a little at a time, stirring frequently for 24 hours; then add about 5 gals. muriatic acid, or, until the work comes out a dark brown.

ALKALI BRONZE.—Dissolve 5 lbs. nitrate of copper in 3 gals. water, with 5 lbs. pearlsh; add 1 or 2 pints potash water; then add from 2 to 3 lbs. sal-ammoniac, or, until the work comes out the required color.

COATING DIP.—Sulphate of zinc, 8 lbs.; oil of vitriol, 5 gals.; aqua fortis, $\frac{3}{4}$ gal. To use, warm up scalding hot.

TO CLEAN AND POLISH BRASS.—Wash with alum boiled in strong lye, in the proportion of an ounce to a pint; afterwards rub with strong tripoli. Not to be used on gilt or lacquered work.

ORMOLU COLORING.—Alum, 30 parts; nitrate of potassa, 30 parts; red ochre, 30 parts; sulphate of zinc, 8 parts; common salt, 1 part; sulphate of iron, 1 part. It is applied with a soft brush. The articles are placed over a clear charcoal fire until the salts, melted and dried, assume a brown aspect. They are then suddenly cooled in nitric acid water containing 3 per cent. of hydrochloric acid; afterwards washed in abundance of water and dried in sawdust.

QUICK BRIGHT DIPPING ACID, FOR BRASS WHICH HAS BEEN ORMOLUED.—Sulphuric Acid, 1 gal.; nitric acid, 1 gal.

DIPPING ACID.—Sulphuric acid, 12 lbs.; nitric acid, 1 pint; nitre, 4 lbs.; soot, 2 handfuls; brimstone, 2 oz. Pulverize the brimstone, and soak it in water an hour. Add the nitric acid last.

GOOD DIPPING ACID FOR CAST BRASS.—Sulphuric acid, 1 qt.; nitre, 1 qt.; water, 1 qt. A little muriatic acid may be added or omitted.

ORMOLU DIPPING ACID, FOR SHEET BRASS.—Sulphuric acid 2 gals.; nitric acid, 1 pt.; muriatic acid, 1 pt.; nitre 12 lbs. Put in the muriatic acid last, a little at a time, and stir the mixture with a stick.

DIPPING ACID.—Sulphuric acid, 4 gals; nitric acid, 2 gals; saturated solution of sulphate of iron (copperas), 1 pint; solution of sulphate of copper, 1 qt.

ORMOLU DIPPING ACID, FOR SHEET OR CAST BRASS.—Sulphuric acid, 1 gal.; sal ammoniac, 1 oz.; sulphur (in flour), 1 oz.; blue vitriol, 1 oz.; saturated solution of zinc in nitric acid, mixed with an equal quantity of sulphuric acid, 1 gal.

TO PREPARE BRASS WORK FOR ORMOLU DIPPING.—If the work is oily, boil it in lye; and if it is finished work, filed or turned, dip it in old acid, and it is then ready to be ormolued; but if it is unfinished, and free from oil, pickle it in strong sulphuric acid, dip in pure nitric acid, and then in the old acid, after which it will be ready for ormoluing.

TO REPAIR OLD NITRIC ACID ORMOLU DIPS.—If the work after dipping appears coarse and spotted, add vitriol till it answers the purpose. If the work after dipping appears too smooth, add muriatic acid and nitre till it gives the right appearance.

The other ormolu dips should be repaired according to the receipts, putting in the proper ingredients to strengthen them. They should not be allowed to settle, but should be stirred often while using.

TINNING ACID, FOR BRASS OR ZINC.—Muriatic acid, 1 qt.; zinc, 6 oz. To a solution of this, add water, 1 qt.; sal-ammoniac, 2 oz.

VINEGAR BRONZE, FOR BRASS.—Vinegar, 10 gals.; blue vitriol, 3 lbs.; muriatic acid, 3 lbs.; corrosive sublimate, 4 grs.; sal-ammoniac, 2 lbs.; alum, 8 oz.

DIRECTIONS FOR MAKING LACQUER.—Mix the ingredients, and let the vessel containing them stand in the sun, or in a place slightly warmed, three or four days, shaking it frequently till the gum is dissolved, after which let it settle from twenty-four to forty-eight hours, when the clear liquor may be poured off for use. Pulverized glass is sometimes used, in making lacquer, to carry down the impurities.

LACQUER FOR DIPPED BRASS.—Alcohol, proof specific gravity not less than 95-100ths, 2 gals.; seed lac, 1 lb.; gum copal, 1 oz.; English saffron, 1 oz.; annotto, 1 oz.

LACQUER FOR BRONZED BRASS.—To one pint of the above lacquer, add gamboge, 1 oz.; and, after mixing it, add an equal quantity of the first lacquer.

DEEP GOLD-COLORED LACQUER.—Best alcohol, 40 oz.; Spanish annotto, 8 grs.; turmeric, 2 drs.; shellac, $\frac{1}{2}$ oz.; red sanders, 12 grs.; when dissolved, add spirits of turpentine, 30 drops.

DEEP GOLD-COLORED LACQUER FOR BRASS NOT DIPPED.—Alcohol, 4 gals.; turmeric, 3 lbs.; gamboge, 3 oz.; gum sanderach, 7 lbs.; shellac, $1\frac{1}{2}$ lbs.; turpentine varnish, 1 pint.

GOLD-COLORED LACQUER, FOR DIPPED BRASS.—Alcohol, 36 oz.; seed lac, 6 oz.; amber, 2 oz.; gum gutta, 2 oz.; red sandal wood, 24 grs.; dragon's blood, 60 grs.; oriental saffron, 36 grs.; pulverized glass, 4 oz.

GOLD LACQUER, FOR BRASS.—Seed lac, 6 oz.; amber or copal, 2 oz.; best alcohol, 4 gals.; pulverized glass, 4 oz.; dragon's blood, 40 grs.; extract of red sandal wood obtained by water, 30 grs.

LACQUER FOR DIPPED BRASS.—Alcohol, 12 gals. ; seed lac, 8 lbs. ; turmeric, 1 lb. to a gallon of the above mixture ; Spanish saffron, 4 oz. The saffron is to be added for bronze work.

GOOD LACQUER.—Alcohol, 8 oz. ; gamboge, 1 oz. ; shellac, 3 oz. ; annatto, 1 oz. ; solution of 3 oz. of seed lac in 1 pint of alcohol ; when dissolved, add $\frac{1}{2}$ oz. Venice turpentine, $\frac{1}{4}$ oz. dragon's blood, will make it dark ; keep it in a warm place four or five days.

TO BRONZE IRON CASTINGS.—Cleanse thoroughly, and afterwards immerse in a solution of sulphate of copper, when the castings will acquire a coat of the latter metal. They must be then washed in water.

ANTIQUÉ BRONZE PAINT.—Sal-ammoniac, 1 oz. ; cream tartar, 3 oz. ; common salt, 6 oz. Dissolve in 1 pint hot water, then add 2 oz. of nitrate of copper dissolved in $\frac{1}{2}$ pint water, mix well, and apply it repeatedly to the article, in a damp situation, with a brush.

GILDERS PICKLE.—Alum and common salt, each, 1 oz. ; nitre, 2 oz. ; dissolved in water, $\frac{1}{2}$ pt. Used to impart a rich yellow color to gold surfaces. It is best used largely diluted with water.

TO SILVER IVORY.—Pound a small piece of nitrate of silver in a mortar, add soft water to it, mix them well together, and keep in vial for use. When you wish to silver any article, immerse it in this solution, let it remain till it turns of a deep yellow ; then place it in clear water, and expose it to the rays of the sun. If you wish to depicture a figure, name, or cipher, on your ivory, dip a camel's-hair pencil in the solution, and draw the subject on the ivory. After it has turned a deep yellow, wash it well with water, and place it in the sunshine, occasionally wetting it with pure water. In a short time it will turn of a deep black color, which, if well rubbed, will change to a brilliant silver.

PALE LACQUER FOR TIN PLATE.—Best alcohol, 8 oz. ; turmeric, 4 drs. ; hay saffron, 2 scs. ; dragon blood, 4 scs. ; red sanders, 1 sc. ; shellac, 1 oz. ; gum sanderach, 2 drs. ; gum mastic, 2 drs. ; Canada balsam, 2 drs. ; when dissolved, add spirits of turpentine, 80 drops.

RED LACQUER FOR BRASS.—Alcohol, 8 gals. ; dragon's blood, 4 lbs. ; Spanish annatto, 12 lbs. ; gum sanderach, 13 lbs. ; turpentine, 1 gal.

PALE LACQUER, FOR BRASS.—Alcohol, 2 gals. ; Cape aloes, cut small, 3 oz. ; pale shellac, 1 lb. ; gamboge, 1 oz.

BLUE BRONZE ON COPPER.—Clean and polish well, then cover the surface with a fluid obtained by dissolving vermilion in a warm solution of sulphide of sodium, to which some caustic potassa has been added.

APPLICATION OF BRONZE POWDERS.—The proper way is to varnish the article and then dust the bronze powder over it, after the varnish is partially dried.

BRONZE DIP.—Sal-ammoniac, 1 oz. ; salt of sorrel (binoxolate of potash), $\frac{1}{2}$ oz. dissolved in vinegar.

PARISIAN BRONZE DIP.—Sal-ammoniac, $\frac{1}{2}$ oz. ; common salt, $\frac{1}{2}$ oz. ; spirits of hartshorn, 1 oz. dissolved in an English quart of vinegar. A good result will be obtained by adding $\frac{1}{2}$ oz. of sal-ammoniac, instead of the spirits of hartshorn. The piece of metal

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being well cleaned is to be rubbed with one of these solutions, then dried by friction with a fresh brush.

BEST LACQUER, FOR BRASS.—Alcohol, 4 gals.; shellac, 2 lbs.; amber gum, 1 lb.; copal, 20 oz.; seed lac, 3 lbs.; saffron, to color; pulverized glass, 8 oz.

COLOR FOR LACQUER.—Alcohol, 1 qt.; annatto, 4 oz.

GREEN BRONZE DIP.—Wine vinegar, 2 qts.; verditer green, 2 oz.; sal-ammoniac, 1 oz.; salt, 2 oz.; alum, $\frac{1}{2}$ oz.; French berries, 8 oz.; boil the ingredients together.

AQUA FORTIS BRONZE DIP.—Nitric acid, 8 oz.; muriatic acid, 1 qt.; sal-ammoniac, 2 oz.; alum, 1 oz.; salt, 2 oz.

OLIVE BRONZE DIP, FOR BRASS.—Nitric acid, 3 oz.; muriatic acid, 2 oz.; add titanium or palladium, when the metal is dissolved, add 2 gals. pure soft water to each pint of the solution.

BROWN BRONZE PAINT, FOR COPPER VESSELS.—Tincture of steel, 4 oz.; spirits of nitre, 4 oz.; essence of leadi, 4 oz.; blue vitriol, 1 oz.; water, $\frac{1}{2}$ pint. Mix in a bottle; apply it with a fine brush, the vessel being full of boiling water; varnish after the application of the bronze.

BRONZE FOR ALL KINDS OF METAL.—Muriate of ammonia (sal-ammoniac), 4 drs.; oxalic acid, 1 dr.; vinegar, 1 pint. Dissolve the oxalic acid first; let the work be clean; put on the bronze with a brush, repeating the operation as many times as may be necessary.

BRONZE PAINT, FOR IRON OR BRASS.—Chrome green, 2 lbs.; ivory black, 1 oz.; chrome yellow, 1 oz.; good japan, 1 gill; grind all together, and mix with linseed oil.

GREEN BRONZE.—Dissolve 2 oz. nitrate of iron, and 2 oz. hyposulphite of soda, in 1 pt. water. Immerse the article until the required shade is obtained, as almost any shade from brown to red can be obtained, according to the time of immersion, then well wash with water, dry and brush.

PALE DEEP OLIVE GREEN BRONZE.—Perchloride of iron, 1 part; water, 2 parts; mix, and immerse the brass.

DARK GREEN.—Saturate nitric acid with copper, and immerse the brass.

DEAD BLACK ON BRASSWORK.—Rub the surface first with tripoli; then wash it with a solution of 1 part neutral nitrate of tin, with 2 parts chloride of gold; after 10 minutes wipe it off with a wet cloth.

REMOVING ZINC AND IRON FROM PLUMBERS' SOLDER.—Digest the metal in grains in diluted sulphuric acid. The acid will dissolve the zinc first, the iron next, and all traces of these metals by subsequent washing.

TINNING CAST IRON.—Pickle your castings in oil of vitriol; then cover or immerse them in muriate of zinc (made by putting a sufficient quantity of zinc in some spirit of salt): after which dip it in a melted bath of tin or solder.

SILVERING BY HEAT.—Dissolve 1 oz. silver in nitric acid; add a small quantity of salt; then wash it and add sal-ammoniac, or 6 oz. of salt and white vitriol; also $\frac{1}{2}$ oz. corrosive sublimate; rub them together till they form a paste; rub the piece which is to be silvered with the paste; heat it till the silver runs, after which dip it in a weak vitriol pickle to clean it.

TO TIN COPPER AND BRASS.—Boil 6 lbs. cream of tartar and 4 gals. of water and 8 lbs of grain tin or tin shavings. After the material has boiled a sufficient time, the articles to be tinned are put therein and the boiling continued, when the tin is precipitated on the goods in metallic form.

MIXTURE FOR SILVERING.—Dissolve 2 oz. of silver with 3 grs. of corrosive sublimate; add tartaric acid, 4 lbs.; salt, 8 qts.

TO SEPARATE SILVER FROM COPPER.—Mix sulphuric acid, 1 part; nitric acid, 1 part; water, 1 part; boil the metal in the mixture till it is dissolved, throw in a little salt to cause the silver to subside.

TO WRITE IN SILVER.—Mix 1 oz. of the finest pewter or block tin, and 2 oz. of quicksilver together till both become fluid, then grind it with gum water, and write with it. The writing will then look as if done with silver.

BEST BRONZE FOR BRASS.—Take 1 lb. muriatic acid, and $\frac{1}{2}$ lb. white arsenic. Put them into an earthen vessel, and then proceed in the usual manner.

ANOTHER BRONZE FOR BRASS.—One ounce muriate of ammonia, $\frac{1}{2}$ oz. alum, $\frac{1}{2}$ oz. arsenic, dissolved altogether in 1 pt. of strong vinegar.

ZINCING.—Copper and brass vessels may be covered with a firmly adherent layer of pure zinc by boiling them in contact with a solution of chloride of zinc, pure zinc turnings being at the same time present in considerable excess.

CLOUDING METAL WORK.—Metal work may be clouded by putting a piece of fine emery paper under the thumb or finger, and working it over the surface of the metal with a spiral motion.

CEMENT FOR BELTING. *Waterproof.*—Dissolve gutta percha in bisulphide of carbon to the consistence of molasses, slice down and thin the ends to be united, warm the parts, and apply the cement, then hammer lightly on a smooth anvil, or submit the parts to heavy pressure.

TO PREVENT INCrustation IN BOILERS.—1. Charcoal has a great affinity for any thing that causes scale or incrustation in boilers. That made from hard wood is the best, broken in lumps of $\frac{1}{4}$ to $\frac{1}{2}$ inch in size, and the dust sifted out. Two bushels of this will generally protect a boiler of 30 horse power for 3 weeks, when running, after which the old coal should be removed and fresh coal used. 2. Throw into the tank or reservoir from which your boiler is fed, a quantity of rough bark, in the piece, such as tanners use, sufficient to turn the water of a brown color; if you have no tank, put into the boiler from a half to a bushel of ground bark when you blow off, repeat every month, using only half the quantity after the first time. 3. Add a very small quantity of muriate of ammonia, about 1 lb. for every 1,500 or 2,000 gals. of water evaporated. It will have the effect of softening and disintegrating the carbonate of lime and other impurities deposited by the water during evaporation. 4. Potatoes and some other vegetable substances introduced into the boiler are most effectual in preventing incrustation, and animal substances such as refuse skins, are still more so. 5. An English firm put oak sawdust into their boiler in order to stop a leak, and to their surprise it also resulted in preventing incrustation. I should say if oak sawdust could prevent scale in

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boilers, that there is no visible reason why hemlock and various other kinds of sawdust will not do the same thing. 6. Cows feet with the shanks attached are strongly recommended as a preventative of scale. Two in a large boiler is amply sufficient, and those who wish to do business economically, can get their oil for lubricating purposes cheaply by boiling the feet and shanks for a few hours in a large kettle, setting it aside to cool and then skimming off the oil from the surface of the water, using the feet for the boiler afterwards. If you wish to get rid of the hair on the shanks, you can get rid of that by using lime, &c., as done by tanners.

MANAGEMENT OF THE STEAM ENGINE.—STEAM PACKING.—To pack the cylinder or piston, plait some packing yarn sufficiently tight that it will need driving; if cotton rope is convenient, put in a coil first, driving it to fit tight; then fill the remainder of the chamber of the piston with the plaited yarn, driving it tight and full, leaving room for the nuts to go on the bolts; screw the nuts evenly and alike until they are fast. The packing should be well soaked in bees wax and tallow before using it. A new kind of packing has been brought out lately, consisting of a mixture of duck, paper and tallow mixed in proper proportions. Metallic vulcanized rubber packing is strongly recommended as the best packing. This is so prepared that 300° Fahrenheit will not affect it. No other substance has so much elasticity which stands so high a degree of heat, or which may be used about all parts of the machinery, as this packing, where packing is necessary, namely: cylinder heads, man hole plates, piston rods, steam chests, steam joints, stuffing boxes, &c. The journals of the crank and the T head require close watching; if they are loose in the boxes, or too tight, they will run badly: thus, if tightened too much, they will heat and wear out the brass runners, if they are not sufficiently tight, there is danger of the keys flying out and breaking the engine. All the valves belonging to the engine should be ground in with emery, to keep them from losing either steam or water. Care should be taken of them as they will wear. When you find them leak, they should be ground over again. If suffered to remain long when leaking steam, there may be new ones required.

The boilers require to be often cleaned out, and care should be taken to remove the scales and mud from adhering to the inside, otherwise, if the scales are suffered to remain, the boiler will burn and want repairing. It is necessary to try the gauge-cock often, to see if there is sufficient water in the boilers. There is great danger in running after the water is below the lowermost gauge-cock, and the flues should be kept cleanly swept.

TO MEND BROKEN SAWS.—Pure silver, 19 parts; pure copper, 1 part; pure brass, 2 parts; all to be filed into powder, and thoroughly mixed; place the saw level on the anvil, broken edges in contact, and hold them so; now put a small line of the mixture along the seam, covering it with a larger bulk of powdered charcoal; now with a spirit lamp and a jewellers' blow-pipe, hold the coal dust in place, and blow sufficient to melt the solder mixture; then with a hammer set the joint smooth, and file away any superfluous solder, and you will be surprised at its strength the heat will not injure the temper of the saw.

WRITING INSCRIPTIONS ON METALS—Take $\frac{1}{2}$ lb. of nitric acid and 1 oz. of muriatic acid. Mix, shake well together, and it is ready for use. Cover the place you wish to mark with melted bees-wax; when cold, write your inscription plainly in the wax clear to the metal with a sharp instrument; then apply the mixed acids with a feather, carefully filling each letter. Let it remain from 1 to 10 minutes, according to appearance desired; then throw on water, which stops the process, and remove the wax.

ETCHING FLUIDS.—*For copper.* Aquafortis, 2 oz.; water, 5 oz. *For steel.* Iodine, 1 oz.; iron filings, $\frac{1}{2}$ dr.; water, 4 oz. Digest till the iron is dissolved. *For fine touches.* Dissolve 4 parts each of verdigris, sea salt, and sal-ammoniac, in 8 parts vinegar, add 16 parts water; boil for a minute, and let it cool.

ENGRAVERS' BORDER WAX.—Bees wax, 1 part; pitch, 2 parts; tallow, 1 part. Mix. *Engravers' cement.* Rosin, 1 part; brick dust, 1 part. Mix with heat.

JAPANNERS' GOLD SIZE.—Gum ammoniac, 1 lb.; boiled oil, 8 oz.; spirits turpentine, 12 oz. Melt the gum, then add the oil, and lastly spirits turpentine.

BLACK VARNISH FOR IRON WORK.—Asphaltum, 1 lb.; lamp-black, $\frac{1}{2}$ lb.; resin $\frac{1}{2}$ lb.; spirits turpentine, 1 quart; linseed oil, just sufficient to rub up the lampblack with before mixing it with the others. Apply with a camel's hair brush.

TO PETRIFY WOOD.—Germ salt, rock alum, white vinegar, chalk and pebbles powder, of each an equal quantity. Mix well together. If, after the ebullition is over, you throw into this liquid any wood or porous substance, it will petrify it.

THE FINEST BRONZE.—Put in a clean crucible 7 lbs. copper, melt, then add 3 lbs. zinc, afterward 2 lbs. tin.

GEARING A LATHE FOR SCREW CUTTING.—Every screw cutting lathe contains a long screw called the lead screw, which feeds the carriage of the lathe, while cutting screws; upon the end of this screw is placed a gear, to which is transmitted motion from another gear placed on the end of the spindle, these gears each contain a different number of teeth, for the purpose of cutting different threads, and the threads are cut a certain number to the inch varying from 1 to 50. Therefore to find the proper gears to cut a certain number of threads to the inch, you will first:—multiply the number of threads you desire to cut to the inch, by any small number, four for instance, and this will give you the proper gear to put on the lead screw. Then with the same number, four, multiply the number of threads to the inch in the lead screw, and this will give you the proper gear to put on the spindle. For example, if you want to cut 12 to the inch, multiply 12 by 4, and it will give you 48. Put this gear on the lead screw, then with the same number, 4, multiply the number of threads to the inch in the lead screw. If it is five for instance, it will give you twenty, put this on the spindle and your lathe is geared. If the lead screw is 4, 5, 6, 7, or 8, the same rule holds good. Always multiply the number of threads to be cut, first. Some, indeed most small lathes, are now made with a stud geared into the spindle, which stud only runs half as fast as the spindle, and in finding the gears for these lathes, you will first multiply the number of

threads to be cut, as before, and then multiply the number of threads on the lead screw, as double the number it is. For instance if you want to cut 10 to the inch, multiply by 4, and you get 40, put this on the lead screw, then if your lead screw is five to the inch, you call it 10; and multiply by 4 and it will give you 40. Again put this on your stud and your lathe is geared ready to commence cutting.

CUTTING A SCREW IN AN ENGINE LATHE.—In cutting V thread-screw, it is only necessary for you to practice operating the shipper and slide-screw handle of your lathe, before cutting. After having done this, until you get the motions, you may set the point of the tool as high as the centre, and if you keep the tool sharp, you will find no difficulty in cutting screws. You must, however, cut very light chips, mere scrapings in finishing and must take it out of the lathe often, and look at it from both sides, very carefully, to see that the threads do not lean like fish scales. After cutting, polish with an emery stick, and some emery.

CUTTING SQUARE THREAD SCREWS.—In cutting square thread-screws, it is always necessary to get the depth required, with a tool somewhat thinner than one-half the pitch of the thread. After doing this, make another tool exactly one-half the pitch of the thread, and use it to finish with, cutting a light chip on each side of the groove. After doing this, polish with a pine stick, and some emery. Square threads for strength should be cut one-half the depth of their pitch, while square threads, for wear, may, and should be cut three-fourths the depth of their pitch.

MONGREL THREADS.—Mongrel, or half V, half-square threads are usually made for great wear, and should be cut the depth of their pitch, and for extraordinary wear they may even be cut $1\frac{1}{4}$ the depth of their pitch. The point and the bottom of the grooves should be in width $\frac{1}{4}$ the depth of their pitch. What is meant here by the point of the thread, is the outside surface. And the bottom of the groove is the groove between the threads. In cutting these threads it is necessary to use a tool about the shape of the thread, and in thickness about one-fifth less than the thread is when finished. As it is impossible to cut the whole surface at once, you will cut it in depth about one-sixteenth at a time, then a chip off the sides of the thread and continue in this way alternately till you have arrived at the depth required. Make a gauge of the size required between the threads and finish by scraping with water. It is usually best to leave such screws as these a little large until after they are cut, and then turn off a light chip, to size them, this leaves them true and nice.

PLANING METALS.—The first operation about planing, is to oil your planer and find out if the bed is smooth. If it is not, file off the rough places; then change the dogs to see if they will work well, and find out the movements of the planer. After doing this, bolt your work on to the bed, and if it is a long, thin piece, plane off a chip, then turn it over and finish the other side, taking two chips, the last of which should be very light. Great care should be taken, in bolting it to the bed, not to spring it. After finishing this side turn it to the other side, and take off a light cut to finish it.

PLANING PERPENDICULARLY.—In planing perpendicularly, it is necessary to swivel the bottom of the small head around, so it will stand about three-fourths of an inch inside of square, towards the piece you are to plane. This prevents breaking the tool when the bed runs back.

GEAR CUTTING.—In cutting gears, they are reckoned a certain number of teeth to the inch, measuring across the diameter to a certain line which is marked on the face or sides of the gear with a tool. This line is one-half the depth of the teeth from the outer diameter. That is, if the teeth of the gear are two-tenths of an inch deep, this line would be one-tenth of an inch from the edge and is called the pitch line.

DEPTH OF TEETH.—Every gear cut with a different number of teeth to the inch, should be cut of a depth to the pitch line, to correspond with the number of teeth to the inch. This is called proportion. Therefore, if you cut a gear eight to the inch, the depth to the pitch line should be one-eighth of an inch, and the whole depth of the tooth would be two-eighths. Again, if you cut a gear twelve to the inch, the depth to pitch line should be one-twelfth of an inch, and the whole depth of tooth two twelfths. And again, if you cut a gear twenty to the inch, the depth to pitch line should be one-twentieth of an inch, while the whole depth should be two-twentieths, and so on *ad infinitum*.

MEASURING TO FIND THE NUMBER OF TEETH.—To find the size a certain gear should be, for a certain number of teeth, is an easy matter, if you study carefully these rules. If you want a gear with thirty-two teeth and eight to the inch, it should be four inches measuring across the diameter to the pitch line, and the two-eighths outside of the pitch line would make it four inches and two-eighths. Again, if you want a gear with forty teeth, and ten to the inch, it should measure across the diameter to pitch line four inches, and the two-tenths outside the pitch line would make the whole diameter four inches and two-tenths. And again, if you want a gear with eighty teeth, and twenty to the inch, it should measure to the pitch line, across the diameter, four inches, and the two-twentieths outside the pitch line would make it four inches and two-twentieths, and these examples will form a rule for the measurement of all except bevel gears.

BEVEL GEARS.—These are turned a certain bevel to correspond with each other, according to the angle upon which the shafts driven by them are set. For instance, if two shafts are set upon an angle of ninety degrees, the surfaces of the faces of these gears will stand at an angle of forty-five degrees. To get the surface of these gears, in turning them, puts a straight edge across the face. Then set your level on an angle of forty-five degrees, and try the face of the teeth by placing the level on the straight edge. After turning the face of the teeth, square the outer diameter by the face of the teeth; and to get the size to which you wish to cut, measure from the centre of the face of the teeth. Thus, if a bevel gear is six inches in diameter, and the face of the teeth is one inch, you will measure from the centre of the face, and find it is five inches. On this line you calculate the number of teeth to the inch, and if you want a gear with twenty teeth, and ten to the inch, it should

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measure two inches across the face to the centre of the surface of the teeth; and if the face of the teeth were one inch in length, the diameter of the gear would be three inches, and the inside of the teeth would measure only one inch. Again, if you want to cut a gear with forty teeth, and ten to the inch, it would measure four inches to the centre of the teeth on the surface. And if the surface of the teeth were one inch long, the diameter of the gear would be five inches, while it would only measure three inches inside the teeth. These examples will form a rule for all bevel gears.

DRAW-FILEING AND FINISHING.—To draw-file a piece of work smoothly and quickly, it is best to first draw-file it with a medium fine file, and finish with a superfine file. After doing this, polish the work with dry emery paper and then with emery paper and oil.

LINING BOXES WITH BARBITT METAL.—To line boxes properly, so as to insure their filling every time, it is necessary to heat the box nearly red hot, or at least hot enough to melt the metal. Then smoke the shaft where the metal is to be poured upon it. This insures its coming out of the box easily, after it is cold. After smoking the shaft, put it into the box or boxes, and draw some putty around the ends of them, for the purpose of stopping them, taking care not to press upon it, for if you do it will go into the box and fill a place that ought to be filled with metal; and in the meantime your metal ought to be heated, and after you have poured it, let the box stand till it is nearly cold; drive out your shaft, and it is done.

PUTTING MACHINES TOGETHER.—In putting machines together no part should be finished except where it is necessary to make a fit, as it is sometimes the case that machinery is miscalculated, and by finishing it would be spoiled, while if it were not, it might be saved by slight alterations in design. And again, in finishing certain parts before you get a machine together, you are unknowingly finishing parts not necessary to be finished, and making them of a shape anything but desirable. This rule, however, is not intended to apply to machinery being made to detail drawings.

TO DRILL A HOLE WHERE YOU HAVE NO REAMER.—It is sometimes necessary to drill a hole of an exact size to fit a certain shaft, and at the same time have it smooth without reaming it. This may be done, by first drilling a hole, one-hundredth of an inch smaller than the size desired, and then making a drill the exact size and running it through to finish with. This last drill should have the corners of its lips rounded, like a reamer, and the hole should be finished without holding the drill with a rest.

SQUARING, OR FACING UP CAST IRON SURFACES.—A round-end, tool is best for this. A rough chip should first be taken off, over the entire surface to be faced. Then speed your lathe up and taking a light chip, merely enough to take out the first tool marks, run over the entire surface again. In turning up surfaces it is always best to begin at the centre and feed out, as the tool cuts freer and will wear twice as long.

BORING A HOLE WITH A BORING TOOL.—In boring a hole with a boring tool, it is usually necessary to drill the hole first, and too much care cannot be taken in finishing. An iron gauge should be

made first; it is usually made of a piece of sheet iron or wire. The hole should then be drilled smaller than the size desired, and then bored to the required size, and it is impossible to bore a hole perfect without taking two or three light chips, mere scrapings with which to finish. Holes, in this way may be bored as nicely as they can be reamed.

BORING HOLES WITH BORING ARBOR.—A boring arbor is a shaft with a steel set in it, for the purpose of boring holes of great length, and is designed to be used in a lathe. In doing this properly, you must first see if your lathe is set straight; if not, adjust it. Having done this, put the piece of work to be bored in the carriage of your lathe, pass your arbor through the hole to be bored, and put it on the centres of your lathe. Having done this, adjust your work true to the position desired by measuring from the point of the tool, continually turning round the arbor from side to side of the piece to be bored, while you are bolting it to the carriage, and measure until it is perfectly true. Having done this, bore the hole, and take for the last chip only a hundredth of an inch. This makes a true and smooth hole. It is impossible to make a hole true with any kind of a tool when you are cutting a large chip, for the tool springs so that no dependence can be placed upon it.

TO MAKE A BORING ARBOR AND TOOL THAT WILL NOT CHATTER.—Boring tools, when used in small arbors, are always liable to chatter and make a rough hole. To prevent this, the tool should be turned in a lathe, while in its position in the arbor, upon the circle of the size of the hole to be bored, and the bearing lengthwise of the arbor, should be only as wide as the feed of the lathe; for if the bearing of a tool is on the face, the more it will chatter.

TO REDUCE METALLIC OXIDES.—This may be effected by the dry and the moist processes; but the deoxidizing agent of the greatest value to the metallurgist is coal in its several varieties, and the derivative materials yielded by its combustion. When coal is burned in a furnace, the product of combustion may be considered to be carbonic acid gas; but inasmuch as the latter is readily decomposed by permeating ignited pieces of solid carbon (coke), losing a portion of its oxygen, and becoming carbonic acid gas, we may say that the products of the combustion of coal are, firstly, carbonic acid; secondly, carbonic oxide and carbonic acid; and lastly, carbonic oxide alone. The latter, in combination with heat, is a most powerful deoxidizing agent. Were it not for the production in furnaces of carbonic oxide gas—were it necessary that the solid carbon of the coke should be alone the deoxidizing body—then it follows that every particle of the ore to be reduced must be brought into intimate contact with the reducing body: a process involving more care and trouble than are compatible with large metallurgic operations. The reducing agent being a gas, there is no longer a necessity for that intimate mixture of fuel and ore which would otherwise be necessary. Provided that the gaseous results of combustion are placed under circumstances of readily permeating the ore, the necessities of practice are amply subserved. There is great difference as to the amount of heat at which the reduction of different metallic oxides can be effected. The oxides of

lead, bismuth, antimony, nickel, cobalt, copper, and iron require a strong red heat in the furnace, whilst the oxides of manganese, chromium, tin, and zinc, do not lose their oxygen until heated to whiteness.

On a large scale, the reduction of oxides is generally effected by mixing charcoal, together with the oxide to be reduced, in a refractory clay crucible, the charcoal furnishing the carbon necessary to the proper performance of this work. Some use a crucible thickly lined with charcoal, putting in the oxide on the top of the charcoal. It is necessary, however, when using the crucible and charcoal, to use a flux, say a little borax in powder, strewed on the mixture to accelerate the reduction of the oxide. The borax is generally the first to fuse, and, as the metal is eliminated, seems to purify and cleanse it, as it gathers into a button at the bottom of the crucible. It is all the better if you give the crucible a few sharp taps when you take it off the fire.

COPPER PLATES OR RODS may be covered with a superficial coating of brass by exposing to the *fumes* given off by melted zinc at a light temperature. The coated plates or rods can then be rolled into thin sheets, or drawn into wire.

SOLUTION OF COPPER OR ZINC.—Dissolve 8 oz. (troy) cyanide of potassium, and 3 oz. cyanide of copper or zinc, in 1 gal. of rain water. To be used at about 160° F., with a compound battery of 3 to 12 cells.

BRASS SOLUTION.—Dissolve 1 lb. (troy) cyanide of potassium, 2 oz. cyanide of copper, and 1 oz. cyanide of zinc, in 1 gal. of rain-water; then add 2 oz. of muriate of ammonia. To be used at 160° F., for smooth work, with a compound battery of from 3 to 12 cells.

BRASSING IRON.—Iron ornaments are covered with copper or brass, by properly preparing the surface so as to remove all organic matter which would prevent adhesion, and then plunging them into melted brass. A thin coating is thus spread over the iron, and it admits of being polished or burnished.

TO ENAMEL CAST IRON AND HOLLOW WARE.—1. Calcined flints, 6 parts; Cornish stone or *composition*, two parts; litharge, 9 parts; borax, 6 parts; argillaceous earth, 1 part; nitre, 1 part; calx of tin, 6 parts; purified potash, 1 part. 2. Calcined flints, 8 parts; red lead, 8 parts; borax, 6 parts; calx of tin, 5 parts; nitre, 1 part. 3. Potters' composition, 12 parts; borax, 8 parts; white lead, 10 parts; nitre, 2 parts; white marble, calcined, 1 part; purified potash, 2 parts; calx of tin, 5 parts. 4. Calcined flints, 4 parts; potters' composition, 1 part; nitre, 2 parts; borax, 8 parts; white marble, calcined, 1 part; argillaceous earth, $\frac{1}{2}$ part; calx of tin, 2 parts. Whichever of the above compositions is taken must be finely powdered, mixed, and fused. The vitreous mass is to be ground when cold, sifted, and levigated with water; it is then made into a pap with water, or gum water. The pap is smeared or brushed over the interior of the vessel, dried, and fused with a proper heat in a muffle. Clean the vessels perfectly before applying.

ENAMELLED CAST IRON.—Clean and brighten the iron before applying. The enamel consists of two coats—the body and the

glaze. The body is made by fusing 100 lbs. ground flints, 75 lbs. of borax, and grinding 40 lbs. of this frit with 5 lbs. of potter's clay, in water, till it is brought to the consistence of a pap. A coat of this being applied and dried, but not hard, the glaze-powder is sifted over it. This consists of 100 lbs. Cornish stone in fine powder, 117 lbs. of borax, 35 lbs. of soda ash, 35 lbs. of nitre, 35 lbs. of sifted slaked lime, 13 lbs. of white sand, and 50 pounds of pounded white glass. These are all fused together; the frit obtained is pulverized. Of this powder, 45 lbs. are mixed with 1 lb. of soda ash, in hot water, and, the mixture being dried in a stove, is the glaze powder. After sifting this over the body-coat, the cast-iron article is put into a stove, kept at a temperature of about 212°, to dry it hard, after which it is set in a muffle-kiln, to fuse it into a glaze. The inside of pipes is enamelled (after being cleaned) by pouring the above body composition through them while the pipe is being turned around to insure an equal coating; after the body has become set, the glaze pap is poured in in like manner. The pipe is finally fired in the kiln.

To ENAMEL COPPER AND OTHER VESSELS.—Flint glass, 6 parts; borax, 3 parts; red lead, 1 part; oxide of tin, 1 part. Mix all together, frit, grind into powder, make into a thin paste with water, apply with a brush to the surface of the vessels, after sealing by heat and cleaning them, repeat with a second or even a third coat, afterwards dry, and lastly fuse on by heat of an enamelled kiln.

EMERY WHEELS FOR POLISHING—Coarse emery powder is mixed with about half its weight of pulverized Stourbridge loam, and a little water or other liquid to make a thick paste; this is pressed into a metallic mould by means of a screw-press, and, after being thoroughly dried, is baked or burned in a muffle at a temperature above a red, and below a white heat. This forms an artificial emery stone, which cuts very greedily, with very little wear to itself. Unequalled for grinding and polishing glass, metals, enamels, stones, &c.

HOLES IN MILLSTONES are filled with melted alum, mixing burr sand with it. If the hole is large, put some pieces of burr mill stones in it first, and pour in melted alum. These pieces of block should be cut exactly to fit. There should be small joints, and fastened with plaster of Paris. These holes should be cut at least 4 inches deep; there is then no danger of their getting loose.

FITTING A NEW BACK ON AN OLD MILLSTONE.—Block your stone up with a block of wood, having its face down until it lies even, solid, and perfectly level; then pick and scrape off all the old plaster down to the face blocks, so that none remains but what is in the joints of the face blocks; then wash these blocks, and keep them soaked with water. Keep a number of pieces of burr blocks, at the same time, soaked with water. Take a pail half filled with clean water, and mixed with 2 tablespoonfuls of glue water, boiled and dissolved; mix in with your hand plaster of Paris until it be thick enough that it will not run; and, breaking all the lumps, pour this on the stone, rubbing it in with your hand; the stone being at the same time damped; and place small pieces of stone all over the joints of the face blocks; you then, with more plaster, mixed in the same way but more stiff, with this and pieces of burr

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stones, build walls round the eye and verge 4 or 5 inches high leaving the surface uneven and the eye larger, as it will be brought to its proper size by the last operation. It is better to build up the wall of the running stone round the verge for 3 inches without any spalls, so that the holes may be cut in to balance it. If you wish to make your stone heavier, you will take small pieces of iron, perfectly clean and free from grease, and lay them evenly all around the stone in the hollow place between the two walls just built; and, with plaster mixed a little thicker than milk, pour in under and through all the crevices in the iron until the surface is nearly level with the two walls. If the stones do not require additional weight added, instead of iron, use pieces of stone the same way, leaving the surface rough and uneven. Again, as before, build walls round the verge of the stone, and round the eye of the stone, until they are within 2 inches of the thickness you want your stones to be, the wall round the eye being 2 inches higher than that round the verge, and filling the space between the walls with stones; and, pouring in plaster again, make it nearly level with the walls, but leaving the surface rough and jagged, to make the next plaster adhere well to it. Let it stand until the back is dry, and perfectly set, when you raise the stone upon its edge, and, with a trowel, plaster round the edge of the stone neatly, giving it a taper of half an inch from the face to the back of the stone. When cased round in this way, lay the stone down on the cock-head; it being in the balance ryne, but the driver off, then raise the spindle, and balance the stone as already directed before putting on the remainder of the back. Then have a tin made the size of the eye, and to reach from the balance ryne to the thickness you want the stone to be at the eye. This tin should be exactly fitted to its place, and made fast; then fit a hoop of wood or iron round the verge, having the upper edge of the thickness from the face you want the stone to be at the verge, and equal all round. This hoop should be greased; and, all the cracks round it, and the tin in the eye, being stopped, you pour thin plaster (with more glue water than in previous operations, to prevent it from setting so quickly, and to give time to finish off the back correctly) until it be level with the hoop round the verge, and with a straight edge, one end resting on the hoop, and the other end resting on the tin at the eye; then, by moving it round, and working the plaster with a trowel, make the surface of the back even and smooth between these two points. The hoop is then taken off, and the back and edges planed smooth; then lower the spindle until your runner lies solid, and put your band or hoop on, it being first made nearly red hot, and taking care that it is of sufficient size not to require too much driving; if fitting too tightly, it may loosen the back in driving it to its proper place; it may be cooled gently by pouring water on it; and, when cool, it should fit tight.

BALANCING A MILLSTONE.—First, take off the driver, that the stone may have full play on the cock-head; then raise the spindle so that there may be room between the stones to see the balance. Find the heaviest parts, and near the verge lay on sufficient weight to balance it. Cut a hole in the back of the stone, as deep as you can make it and as near the verge as possible that the binding

iron hoop of the stone may keep the lead in its place. This hole should be wider at the bottom than the top in order to retain the lead when the stone is in motion, and into this the melted lead should be poured until it brings the stone completely into balance. When the lead is cold, cover over with mixed plaster, even with the back of the stone.

COMPOSITION TO KEEP MILLSTONES CLEAN.—Hot-water, 1 gal.; borax, 2 oz.; washing soda, $\frac{1}{4}$ lb. and 3 balls of the size of a hazel nut each of sal prunel. Mix and apply it to the burrs with a scrubbing brush. When grinding garlic wheat it is not necessary to take up the burrs at all. It is sufficient to drop through the eye of the burr twice per day one of the above described balls of sal prunel and that will keep the burrs sharp and clean, enabling the miller at all seasons to use the No. 13 bolt, to make finer flour and in greater quantity than usual.

TO VULCANIZE INDIA RUBBER.—The vulcanizing process patented by the late Charles Goodyear consists in incorporating with the rubber from 3 to 10 per cent of sulphur, together with various metallic oxides, chiefly lead and zinc, the quantity of the latter articles being regulated by the degree of elasticity &c., required in the desired article. The goods of one large establishment are vulcanized in cylindrical wrought iron steam heaters, over 50 feet long and from 5 to 6 feet in diameter. These heaters have doors opening on hinges at one end, and through these doors the goods to be vulcanized are introduced on a sort of railway carriage, then, after the door is shut, steam is let on, and a temperature of from 250° to 300° of heat is kept up for several hours, the degree of heat being ascertained by means of thermometers attached to the heaters. The value, solidity, and quality of the goods is much increased by keeping the articles under the pressure of metallic moulds or sheets while undergoing this process. The whole process requires careful manipulation and great experience to conduct it properly.

TO DEODORIZE RUBBER.—Cover the articles of rubber with charcoal dust, place then in an enclosed vessel, and raise the temperature to 94° Fahr., and let it remain thus for several hours. Remove and clean the article from the charcoal dust, and they will be found free from all odor.

APPROVED FRICTION MATCHES.—About the best known preparation for friction matches consists of gum arabic, 16 parts by weight; phosphorus, 9 parts; nitre, 14 parts; peroxyd of manganese, in powder, 16 parts. The gum is first made into a mucilage with water, then the manganese, then the phosphorus, and the whole is heated to about 130 degr. Fah. When the phosphorus is melted the nitre is added, and the whole is thoroughly stirred until the mass is a uniform paste. The wooden matches prepared first with sulphur, are then dipped in this and afterward dried in the air. Friction papers, for carrying in the pocket, may be made in the same manner, and by adding some gum benzoin to the mucilage they will have an agreeable odor when ignited.

MILL DAMS.—When building a dam, you should select the most suitable place. If you can, place it across the stream near a rocky bluff, so that the ends of the dam may run into the bluff. This will prevent the water running by at the ends of the dam. Build

your dam very strong: if this is not done, they are breaking up often, causing ruinous expense in money and loss of time.

Rock DAMS are incomparably the best in use, if there is plenty of material at hand for building, and a rock bottom to the stream; if there is not a rock bottom, you should dig a trench in the bottom, deep enough, so that the water cannot undermine it. This should be the same as if you were building the foundation of a large building. The wall to be built should be of a small, circular form, so that the back of the circle should be next to the body of water, which may by its pressure tighten it. To secure the water from leaking through at the ends of the dam, dig a ditch deeper than the bottom of the river; then fill this with small pieces of rock, and pour in cement. This cement is made of hydraulic cement, and is made of one part of cement to five parts of pure sand. It will effectually stop all crevices. A rock dam, if well built, will be perfectly tight. Use as large rock as you conveniently can move; building this wall 4 to 6 feet thick, according to the length of the dam, with jam or buttresses every place where they are needed to strengthen it. Make true joints to these rocks, especially on the ends so that they may join close together. When you have the outside walls laid in cement, for every layer fill the middle up with pieces of small rock, pouring in your grout, so that there may not be a crevice but what is filled. If there is any crevice or hole left open, the water will break through, wearing it larger and larger. If the stream is wide and large, it is necessary to build the dam in two sections, which should be divided by a waste way, necessary for the waste, or surplus water, to run over to keep the head in its proper place or height. Let each section, next to where the water is to be run over, be abutments, built to strengthen the dam. The last layer of rock, on the top where the waste water runs over, should project 5 or 6 inches over the back of the dam, so that the water may not undermine it. This last layer should be of large rocks and jointed true; then laid in hydraulic cement, in proportion of 1 of cement to 3 of sand. When the dam is built, the front should be filled up with coarse gravel or clay; this is best done with teams, as the more it is tramped the more durable it becomes.

FRAME-DAMS.—In building a frame-dam commence with a good foundation, laying the first sills in the bottom, of sufficient depth. They should be large square timbers that will last in the water without rotting. Where there is a soft foundation, the bottom should first be made level; then dig trenches for the mud sills, about 7 or 8 feet apart, lengthways of the stream, and 10 or 12 feet long. Into these first sills other sills must be framed, and put crosswise of the stream, 6 or 8 feet apart, to reach as far across the stream as necessary. Then two outside sills should be piled down with 2-inch plank driven down to a depth of 4 or 5 feet. If this can be done conveniently, they are to be jointed as closely as possible. It would be better to line with some stuff 1 inch thick; then with posts their proper length, about 12 or 14 inches square, which should be framed into the uppermost sills, in both sides, and all the way across the dam, from bank to bank, at a distance of 6 feet apart. Then, with braces to each post, to extend two-thirds

of the length of the post, where they should be joined together with a lock, instead of a mortise and tenon, with an iron bolt of 1 or 1½ inches in diameter, going through both, and tightened with a screw and nut. When mortises and tenons are used, they often become rotten and useless in a few years. These braces should be set at an angle of 50 or 60° with the other end mortised into the mud sill. These braces require to be about 6 to 8 inches, and as long as you find necessary; being covered with dirt, it will not decay for a long time, as the air is excluded. These posts should be capped from one to the other, plate fashion. The posts should be lined with 2 or 2½ inch plank on the inside, pinned to the plank, and should, in the middle, be filled in with dirt.

If the stream is large and wide, the dam should be built in two sections, which should be divided by a waste-way for the surplus water, which should be in the centre of the dam, and sufficient for all the waste-water to run over. Let each section of the dam form an abutment next to the waste-way, placing cells or sills 4 feet apart the length of the waste-way; in each of these sills, posts should be framed, with a brace for the sides. These rows of posts, standing across the dam, will form the sectional abutments; the middle one may be constructed by being lengthways of the stream, with short braces, so that they will not be in the way of drift-wood passing down the stream; it being necessary for strong pieces for a bridge. Then cover the sills with an apron of 2-inch plank joined perfectly straight, to extend 30 or 40 feet below the dam, to prevent undermining of the dam. The planks which are used for the purpose of lining the posts which form the abutments of each section of the dam, and the ends of the waste-way, should be truly pointed, so as to prevent any leakage. The dam being built, the dirt should be filled in with teams, as the more it is tramped the better. Clay or coarse gravel is the best. Then place your gates on the upper side of the waste-way, the size that is necessary to a level with low-water mark; which gates are not to be raised, except in times of high water, as the proper height of the mill-pond should be regulated by boards placed over the gate for the desired head, as the water should be allowed to pass at all times freely over them. To strengthen the dam, if you think necessary, 2-inch plank may be used in lining the front side of the dam, long enough to reach from the bottom of the stream (on an inclined plane, and next to the body of water) to the top of the dam, and filled up nearly to the top of the dam with clay or gravel well trampled down.

BRUSH OR LOG DAMS are very often used in small, muddy streams. When the bottom of the stream is of a soft nature, take a flat boat where you want to fix your dam, and drive piles the whole length of the stream, about 3 or 4 feet apart, as deep as you can. Take young oak saplings, pointed at the end, for the purpose. If you can, construct a regular pile-driver, similar to those in use for making trestle-work on the railways. This weight may be pulled up by horses instead of an engine. When you have finished driving piles, make some boxes or troughs of 2 or 3 inch plank, about 3 feet wide and as long as the plank is. Sink these in the water, the length of the dam, close to the piles, by loading them with

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rock, until they are at the bottom of the stream, filling in the front part of the dam with dirt and brush, nearly to the height you want it. This kind of dam will last a long time.

Whenever there is a small break in the dam or race, cut up some willows and brush, put them in the break along with some straw and dirt, and ram them down with clay.

In regard to the flume, the greatest care must be taken to insure strength and durability, combined with tightness. Every step taken in its construction must be of such a nature as to unite these qualities in the highest possible degree, otherwise the whole is, in a manner, labor lost.

CURE FOR DRUNKENNESS.—Take 5 grs sulphate of iron, 10 grs. magnesia, 11 drs. peppermint water, 1 dr spirit of nutmeg; mix all together, and take twice per day.

TO MAKE GUN COTTON.—Take dry saltpetre, $\frac{1}{2}$ oz.; strong oil vitriol, $\frac{1}{2}$ oz. Mix in a tumbler, add 20 grs. of dry cotton wool, stir with a glass rod 5 minutes, remove the cotton and wash from all traces of the acid in 4 or 5 waters; then carefully dry under 120° . This is gun cotton.

THE DRUMMOND LIGHT is produced by directing a jet of mixed oxygen and hydrogen upon a pencil of pure lime, the gases being conveyed in separate tubes or pipes, to within a very short distance from the aperture at which they are to be delivered, and then flowing together and mixing in very minute quantity before combustion takes place. This arrangement is adopted to ensure safety. The gases are used in the proportion of 2 of hydrogen to 1 of oxygen, which form a dreadfully explosive mixture.

NITRO GLYCERINE is made by submitting glycerine to the action of a mixture of 2 parts of sulphuric and 1 part of nitric acid. The use of the sulphuric acid being to concentrate the nitric acid, which is alone concerned in the reaction. In the apparatus ordinarily used, the glycerine and the acids are allowed to mix in the stream, and are afterwards agitated for a short time in the receptacle into which they flow. The nitro-glycerine is then allowed to settle at the bottom, the acids are drawn off and after a single washing with water the explosive is ready for use.

THE GREAT SECRETS FOR TRAPPING FOXES AND OTHER GAME.—Musk-rat musk and skunk musk mixed. Can be procured at the druggists, or from the animals themselves. To be spread on the bait of any trap. This receipt has been sold as high as \$75. *Another, costing \$50. for musks, &c.*—Unslaked lime, $\frac{1}{2}$ lb.; sal-ammoniac, 3 oz., or muriate of ammonia, 3 oz. Mix, and pulverize. Keep in a covered vessel a few days until a thorough admixture takes place. Sprinkle on the bait, or on the ground around the trap. Keep in a corked bottle.

FOOD FOR SINGING BIRDS.—Blanched sweet almonds, pulverized, $\frac{1}{2}$ lb.; pea meal, 1 lb.; saffron, 3 grs.; yolks of 2 hard boiled eggs. Reduce all to a powder by rubbing through a sieve. Place the mixture in a frying pan over a fire, and add 2 oz. butter and 2 oz. honey. Slightly cook for a few minutes, stirring well, then set off to cool, and preserve in a closely corked bottle.

PHOTOGRAPH PAINTING IN OIL COLORS.—**TINTS FOR THE FIRST PAINTING.**—**FLESH.**—*White and Light Red.*—White, Naples yellow,

and vermilion. White, vermilion, and light red. *Gray, Pearly, and Half Tints.*—White, vermilion, and black. White and terre verte. White, black, Indian red, and raw umber. *Deep Shades.*—Light red and raw umber. Indian red, lake and black. *Carnations.*—White and Indian red (powerful color). White and rose madder. White and lake. *HAIR.*—*Light Hair.*—White and yellow ochre. White and Roman ochre. White and Vandyke brown for the dark parts. White and raw umber for the dark parts. *Dark Brown Hair.*—Raw and burnt umber. White and raw umber. White and Vandyke brown. **TINTS FOR THE SECOND AND THIRD PAINTING.**—*High Lights.*—White and Naples yellow. *Carnations.*—Rose madder and white. Indian red, rose madder, and white. *Green Tints.*—White and ultramarine, with any of the yellows. White and terre verte, with the addition of a little raw umber. The above green tints may be converted into green grays. *Gray Tints.*—Ultramarine, light red, and white. Indian red, lake, black and white. White, ultramarine, Indian red, and raw umber. *Purple Tints.*—Any of the lakes or red madders, with ultramarine and white. *Powerful Shadow Tints.*—Indian red, purple lake, and black. Indian red, raw umber, and black. *Strong Glazing Colors.*—Light red and lake. Brown madder. Vandyke brown, Indian red, and lake asphaltum. **DRAPERIES.**—**BACK GROUND COLORS.**—*Pearly.*—White, vermilion, and blue. White, vermilion and black. White and black. *Gray.*—White, Venetian red and black. *Yellow.*—Yellow ochre and white. *Olive.*—Yellow ochre, terre verte, and umber. *Stone.*—Raw umber and yellow. Black, white, and raw umber. *Sky.*—French blue and white. French blue, vermilion, and white. *Edges of Clouds.*—Yellow ochre and white. *Clouds.*—Indian red, lake, and white. Brown madder, French blue, and white.

PHOTOGRAPH WATER COLORS.—**FLESH TINTS.**—No. 1. *Fair Complexion.*—Light red, a little carmine or vermilion, and Indian yellow. Be careful in using the latter, and, in the flesh tints of very fair children, allow the vermilion to predominate; carnations, rose madder, and, if the face be full of color, add a little vermilion to it. 2. *Middling Complexion.*—Much the same as No. 1, saving that the light red must be in excess over the other colors—carnations, rose madder, and lake. 3. *Dark Complexion.*—Light red and Indian yellow, or light red and Roman ochre, and, if the complexion be generally ruddy, you may add a little Indian red, but it must be sparingly used, as it is a powerful color, and likely to impart a purple tone to the flesh. Carnations chiefly lake, but if the complexion be warm, lake and a little yellow. The carnations for children's portraits are rose madder and vermilion, inclining more to the latter tint. Aged persons have rose madder, and a little cobalt to give a cold appearance to the color in their cheeks and lips. These tints, Nos. 1, 2, and 3, are indispensable as general washes, for the purpose of receiving the other colors, which are to be worked over them to bring up the complexion to the life. Uncolored photographic portraits vary so much in tone, that the beginner will, perhaps, find some difficulty in mixing up the tints for the washes. He must note that the warm-toned ones do not require so much Indian yellow as the cold ones do.

TO ISOCRONISM A PENDULUM SPRING.—A pendulum is isochronal when its vibrations are performed in equal times, whether the vibrations be large or small, but it can only possess this property by being constrained to move in a cycloidal arc. This is managed by causing the spring to wrap and unwrap itself round two equal cycloidal cheeks, the diameter of whose generating circle is equal to half the length of the pendulum. Isochronism is closely approximated in practice by causing the pendulum to describe a very small circular arc.

TO WHITEN SILVER WATCH DIALS.—Get a piece of cork, a jeweller's scrub brush, some putty powder, a small japanned saucepan, a spirit lamp, a piece of wire bent into a bow, and a little vitriol. Lay the dial on the cork, wet the end of the brush, dip it in the putty powder, and scrub the dial very clean; then put about a cupful of water in the saucepan, and enough vitriol to make it very tart; make it hot, lay the dial on the wire face upwards, make it white hot over the spirit lamp, drop it flat into the vitriol and water, let it lay a few seconds, if it is at all stained put it in again for a short time; if that does not take it out it must be scrubbed over again: the most particular point is getting the dial to the right heat.

TO CONSTRUCT AN ÆOLIAN HARP.—Make a box with the top, bottom, and sides of thin wood, and the ends $1\frac{1}{2}$ inch beech, form it the same length as the width of the window in which it is to be placed. The box should be 3 or 4 inches deep, and 6 or 7 inches wide. In the top of the box, which acts as a sounding board, make 2 circular holes about 2 inches in diameter, and an equal distance apart. Glue across the sounding board, about $2\frac{1}{2}$ inches from each end, 2 pieces of hard wood $\frac{1}{4}$ inch thick, and $\frac{1}{2}$ inch high, to serve as bridges. You must now procure from any musical instrument maker twelve steel pegs similar to those of a pianoforte, and 12 small brass pins. Insert them in the following manner into the beech. first commence with a brass pin, then insert a steel peg, and so on, placing them alternately $\frac{1}{2}$ in. apart, to the number of twelve. Now for the other end, which you must commence with a steel peg, exactly opposite the brass pin at the other end, then a brass pin, and so on, alternately, to the number of 12; by this arrangement you have a steel peg and a brass pin always opposite each other, which is done so that the pressure of the strings on the instrument shall be uniform. Now string the instrument with 12 first violin strings, making a loop at one end of each string, which put over the brass pins, and wind the other ends round the opposite steel pegs. Tune them in unison, but do not draw them tight. To increase the current of air, a thin board may be placed about 2 inches above the strings, supported at each end by 2 pieces of wood. Place the instrument in a partly opened window, and, to increase the draft, open the opposite door.

TO FORGE A TWIST DRILL.—It is necessary to forge a flat blade similar to a flat drill, and then twist this blade into the resemblance required, then, with a light hammer and careful blows, hammer the twisted edges so that they will be thicker than the central line of the tool. This will give greater strength and a better drill, and, to cut well, the central line or cutting point must be made

quite thin. Be careful to get the same twist at the point of the drill as upon the body of the drill. The inexperienced often leave the point straight, with no twist, like flat drill.

MOULDING SAND FOR CASTING BRASS OR IRON.—The various kinds of good moulding sand employed in foundries for casting iron or brass, have been found to be of almost uniform chemical composition, varying in grain, or the aggregate form only. It contains between 93 and 96 parts siliceous, or grains of sand, and from 36 to 40 parts clay, and a little oxide of iron, in each 100 parts. Moulding sand, which contains lime, magnesia, and other oxides of metal, is not applicable, particularly for the casting of iron or brass. Such sand is either too close, will not stand or retain its form, or it will cause the metal to boil through its closeness.

REFINING FLUXES, FOR METALS.—Deflagrate, and afterwards pulverize, 2 parts of nitre and 1 part of tartar. The following fluxes answer very well, provided the ores be deprived of all their sulphur, or if they contain much earthy matter, because, in the latter case, they unite with them, and convert them into a thin glass, but, if any quantity of sulphur remains, their fluxes unite with it, and form a liver of sulphur, which has the power of destroying a portion of all the metals, consequently the assay must be, under such circumstances, very inaccurate. Limestone, feldspar, fluor-spar, quartz, sand-slate, and slags, are all used as fluxes. Iron ores, on account of the argillaceous earth they contain, require calcareous additions; and the copper ores, rather slags, or nitreous stones, than calcareous earth.

BURNING IRON CASTINGS TOGETHER.—The usual mode is by imbedding the castings in the sand, having a little space left vacant round about the joint where it is to be burned. Two gates must then be provided, one lying on a level with the lower side of this space, and the other raised so that the metal, which must be very hot, is poured in at the higher one; it passes round, fills up the space, and runs off at the lower gate. A constant supply of metal is thus kept up, till the parts of the casting are supposed to be on the eve of melting. The lower gate is then closed, and the supply stopped. When cool, and the superfluous metal chipped off, it forms as strong a joint as if it had been original.

POT METAL.—Copper, 40 lbs.; lead, 16 lbs.; tin, 1½ lbs.

TO BEND GLASS TUBES.—Hold the tube in the upper part of the flame of a spirit-lamp, revolving it slowly between the fingers; when red hot it may be easily bent into any desired shape. To soften large tubes a lamp with a double current of air should be used, as it gives a much stronger heat than the simple lamp.

TO LESSEN NOISE IN WORKSHOPS.—Place a piece of India-rubber under the feet of the machines or benches on which the machines are placed.

TO SOLDER TORTOISE SHELL.—Bring the edges of the pieces of shell to fit each other, observing to give the same inclination of grain to each, then secure them in a piece of paper, and place them between hot irons or pincers; apply pressure, and let them cool. The heat must not be so great as to burn the shell, therefore try it first on a white piece of paper.

TO MAKE LINSEED AND COTTON SEED OILS.—In making linseed oil quite a variety of machinery is used, more or less expensive according to the enterprize and capital of the manufacturer. The seed is first passed through iron rollers, to be crushed or ground, one of the rollers is made to revolve more rapidly than the other, which subjects each seed to a pulling as well as to a crushing process. The meal is taken from the mill to the 'chasers,' when it is subjected to another crushing process, more severe than the first. The chasers are 2 large circular stones about five feet diameter, and 18 inches thick, rolling upon a third stone in the manner of an old-fashioned bark or cider mill. These heavy stones start the oil from the seed, and to keep it from adhering to the chasers it is moistened with water. The meal is next put into an iron cylinder, which is kept revolving over a fire until the water is evaporated. Much of the skill of making oil depends upon this heating process. It must not be scorched, and yet it must be brought up to a high temperature, so that it will readily give out its oil. The presses are of various structure, some of them are patented, and others not open to public inspection. In one, the vats or hoops holding about 2 bushels each, were placed opposite each other against two immense beams or uprights, made fast in the foundations of the building. The followers were forced down upon the meal by 2 large levers worked by hydraulic powers. The meal is kept under pressure about an hour, and the two presses work up about 92 bushels of seed every 24 hours, the mill being kept running night and day. The product is not far from 2 gals. of oil from a bushel of seed, a little more or less, according to the quality of the seed and the skill in pressing. The cakes, as taken from the press, are generally sold by the ton without grinding, and are generally exported in this form, but where there is a market in the vicinity of the mill, the cakes are put under the chasers, ground into meal, bagged and sent to the feed stores. The price of the cake is from \$30 to \$40 per ton; ground into meal it retails at about \$2 per 100 lbs. The process of making the cotton seed oil and cake is nearly the same. The seed of the upland cotton is surrounded with a husk, to which the cotton adheres. It is surrounded with a soft down after it leaves the gin, and in this condition it is purchased from the planter. The seed makes better oil and better meal when it is deprived of this hull and down. The yield of oil is about 90 gallons per 100 bushels of the Sea Island, or 2 gals. to 56 lbs. of the hulled cotton seed.

BLACK DIP FOR BRASS.—Hydrochloric acid (commonly called smoking salts), 12 lb., sulphate of iron 1 lb., and pure white arsenic 1 lb. This dip is used in all the large factories in Birmingham, but the dip used in the London trade is 2 oz. of corrosive sublimate, in 1 pt. of the best vinegar, cork both air tight in a bottle, let it stand 24 hours, then it is fit for use.

TO RE-COVER HAMMERS IN PIANOS.—Got felt of graduated thickness, cut it in strips the exact width, touch only the two ends with glue, not the part striking the strings. Hold in place with springs of narrow hoop iron.

ARTIFICIAL PEARLS.—Are made from beads of opaline glass filled

with gum, the polish of the glass being reduced by the vapor of hydrofluoric acid.

STALBA'S NICKEL PLATING PROCESS.—Consists in plating with nickel, by the action of zinc upon salts of nickel, in the presence of chloride of zinc and the metal to be plated. By this process, Stalbe states that he has succeeded in plating objects of wrought and cast iron, steel, copper, brass, zinc and lead. It is only necessary that the size of the objects should permit them to be covered entirely by the plating liquid, and that their surfaces should be free from dirt. The following is the *modus operandi*:—A quantity of concentrated chloride of zinc solution is placed in a cleaned metallic vessel, and to this is added an equal volume of water. This is heated to boiling, and hydrochloric acid is added drop by drop, until the precipitate which had formed on adding the water has disappeared. A small quantity of zinc powder is now added, which produces a zinc coating on the metal as far as the liquid extends. Enough of the nickel salt (the chloride or sulphate answers equally well) is now introduced to color the liquid distinctly green; the objects to be plated are placed in it, together with some zinc clippings, and the liquid is brought to boiling. The nickel is precipitated in the course of 15 minutes, and the objects will be found to be completely coated. The coating varies in lustre with the character of the metallic surface; when this is polished, the plating is likewise lustrous and *vice versa*. Salt of cobalt affords a cobalt plating, which is steel gray in color, not so lustrous as the nickel, but more liable to tarnish.

GAUGING STREAMS.—Multiply the square root of the cube of the height in inches of the water on the sill of the weir or guage by the constant 17.13, which will give the number of gallons per minute. If the water has any initial velocity it must be determined by experiment, and in that case multiply the square of the height by the square of the velocity, and by 0.8; to the product add the cube of the height, extract the square root of the sum, and multiply by 17.13 as before.

TO PREVENT PITTING WITH SMALL-POX.—As soon as the disease is distinguished, apply an ointment made of lard and charcoal to the face, neck, hands, &c., and continue until all signs of suppurative fever have ceased.

CORNISH REDUCING FLUX—Tartar 10oz., nitre 3oz., and 6drs. borax, 3oz. and 1 dr. Mix together.

TO MAKE COAL OIL—Break the Coal or shale into small pieces and put from 10 to 16 cwt. in an iron retort, heated to a dull red color. Lute the retort door and keep up the heat for 24 hours. By this process a vapor is thrown off which passes through ranges of cisterns until it condenses, when it is run into cisterns. This crude oil, when refined and purified, is sold as paraffin oil, and solid paraffin for making candles is made from it.

DAMASCUS STEEL.—It is said that this steel consists of a highly carburated metal which by undergoing careful cooling and annealing separates into two compounds of iron and carbon, giving it the peculiar appearance known as "Damasceneing." The wonderful strength of this steel is no doubt owing to careful manipulation.

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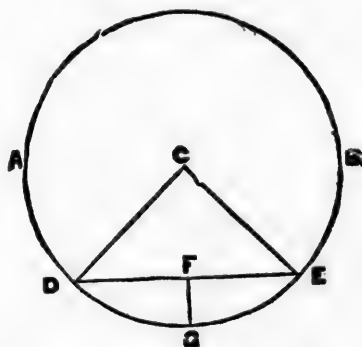
NEW CEMENT FOR STEAM PIPE JOINTS. The new and excellent cement for steam pipe joints, the receipt for which is now (June 1873), being sold all over the country at prices varying from \$2 to \$30, consists of white lead and oxide of manganese, reduced to the consistence of thin putty and applied in the usual manner.

ENGINEER'S BELL SIGNALS IN USE ON STEAMERS.—*Go ahead*, 1 stroke, *Back*, 2 strokes, *Stop*, 1 stroke, *Slowly*, 2 short strokes, *Full speed*, 3 short strokes, *Go ahead Slowly*, 1 long and 2 short strokes, *Back slowly*, 2 long and 2 short strokes, *Go ahead full speed*, 1 long and 3 short strokes, *Back fast*, 2 long and 3 short strokes. *Hurry*, 3 short strokes repeated.

TO DYE METALS.—Metals can be dyed any color by dissolving any of the aniline dyes in methylated spirit and adding shellac. This solution must be painted on until the desired shade is obtained. If the iron has been previously painted white so much the better.

TO FIND THE CIRCUMFERENCE OF ANY DIAMETER.

FIG. 1.



EXPLANATION OF DIAGRAM.

From the centre C describe a circle AB, having the required diameter; then place the corner of the square at the centre C, and draw the lines CD and CE; then draw the chord DE: three times the diameter added to the distance from the middle of the chord DFE to the middle of the subtending arc DGE, will be the circumference sought.

TO FIND THE AREA OF THE SECTOR OF A CIRCLE.

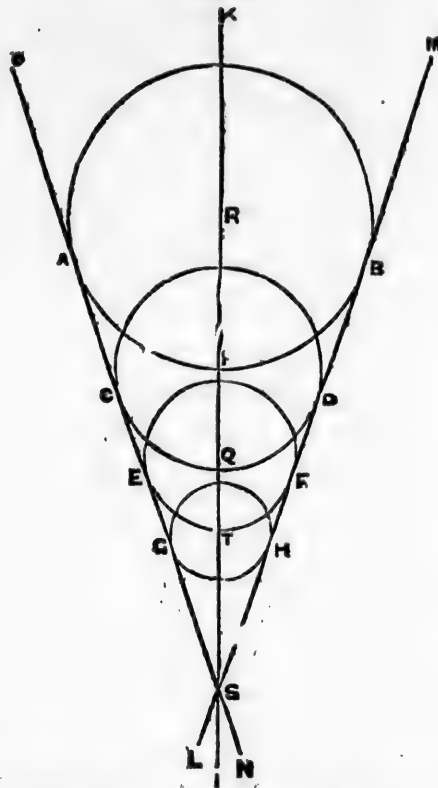
RULE. Multiply the length of the arc DGE by its radius DC, and half the product is the area.

The length of the arc DGE equal $9\frac{1}{2}$ feet, and the radii CD, CE, equal 7 feet, required the area.

$$9.5 \times 7 = 66.5 \div 2 = 33.25 \text{ the area.}$$

PROPORTION OF CIRCLES

FIG. 2.



To enable machinists to enlarge or reduce machinery wheels without changing their respective motion.

First, describe two circles AB and CD the size of the largest wheels which you wish to change to a large or small machine, with the centre P of the smaller circle CD on the circumference of the large one AB; then draw two lines LM and NO tangent to the circles AB and CD and a line IK passing through their centres P and R; then if you wish to reduce the machine, describe a circle the size you wish to reduce it to; if one-half, for example, have the centre Q one-half the distance from R to S and describe the circle EF, and on its circumference T as a centre, describe a circle GH, allowing their circumferences to touch the tangent lines LM and NO, which will make the circle EF one-half the size of the circle AB, and GH one-half the size of CD; therefore EF and GH are in the same proportion to each other as AB and CD.

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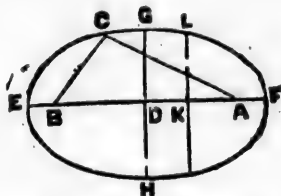
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If you wish to reduce one-third, have the centre Q one-third the distance from R to S; if one-fourth have the centre Q one-fourth the distance from R to S, and so on. This calculation may be applied beyond the centre R for enlarging machine wheels, which will enable you to make the alteration without changing their respective motion.

TO DESCRIBE AN ELLIPSE, OR OVAL.

FIG. 3.



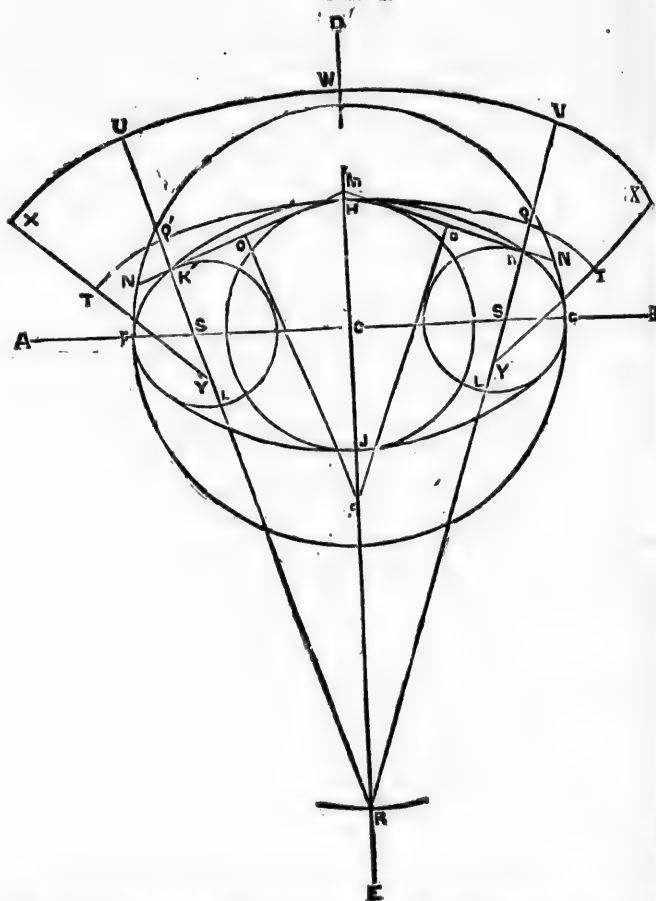
At a given distance, equal to the required eccentricity of the ellipse, place two pins, A and B and pass a string, ACB, round them; keep the string stretched by a pencil or tracer, C, and move the pencil along, keeping the string all the while equally tense, then will the ellipse DGLFH be described. A and B are the foci of the ellipse, D the centre, DA or DB the eccentricity, EF the principal axis or longer diameter, GH the shorter diameter, and if from any point L in the curve a line be drawn perpendicular to the axis then will LK be an ordinate to the axis corresponding to the point L, and the parts of the axis EK, KF into which LK divides it are said to be the abscissæ corresponding to that ordinate.

NOTE. OVAL. A curve line, the two diameters of which are of unequal length, and allied in form to the ellipse. An ellipse is that figure which is produced by cutting a cone or cylinder in a direction oblique to its axis and passing through its sides. An oval may be formed by joining different segments of circles, so that their meeting shall not be perceived, but form a continuous curve line. All ellipses are ovals, but all ovals are not ellipses; for the term oval may be applied to all egg-shaped figures, those which are broader at one end than the other, as well as those whose ends are equally curved.

DOWLAIS IRON WORKS, (England.) Furnaces—Eight, diameter 16 to 18 feet, 1300 Tons Forge Iron per week; discharging 44,000 cubic feet of air per minute. Engine (noncondensing), Cylinder, 55 ins. in diam. by 13 feet stroke of piston. Pressure of Steam, 60 lbs per square inch, cut off at $\frac{1}{2}$ the stroke of the piston. Valves, 120 ins. in area. Boilers. Eight, (Cylindrical flue, internal furnace), 7 feet in diam. and 42 feet in length; one flue 4 ft. in diam. Grates 288 square feet, Fly wheel. Diam. 22 feet. Weight, 25 tons. Blowing Cylinder. 144 ins diam. by 12 ft. stroke of piston, Revolutions, 20 per minute, Blast, $3\frac{1}{4}$ lbs. per square inch, Discharge pipe, diam. 5 ft. and 420 feet in length. Valves, Exhaust, 56 square feet, delivery, 16 square feet.

TO DESCRIBE AN ELLIPSE.

FIG. 4.



To describe an ellipse of any length and width, and by it to describe a pattern for the sides of a vessel of any flare.

First draw an indefinite line DE perpendicular to the line AB, and from C, the point of intersection, as a centre, describe a circle FG, having the diameter equal to the length of the ellipse; from the same centre C describe a circle HJ equal to the width; then describe the end circles K'L and LK, as much less than the width as the width is less than the length; then draw the lines MN and MN, tangent to the circles K'L, HJ and KL; from the middle of the

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line MN at O erect a perpendicular produced until it intersects the indefinite line DE; from the point of intersection P as a centre describe the arc K'HK, and with the same sweep of the dividers, mark the point R on the line DE; from the point R draw the line RU and RV through the points K' and K where the arc K'HK touches the end circle, K'L and KL; then place one foot of the dividers on the point R and span them to the point H, and describe the arc Q'HQ, which will be equal in length to the arc K'HK; from the same centre R describe the arc UWV the width of the pattern; then span the dividers the diameter of the end circle KL; place one foot of the dividers on the line RV at point Q, and the other at Y as a centre, describe the arc QT the length of the curve line KG, and with the same sweep of the dividers describe the arc T'Q' from the centre Y' on the line RU; then span the dividers from Y' to U, and from Y' as a centre describe the arc UX and from Y as a centre describe the arc VX, which completes the description of the pattern.

The more flare you wish the pattern to have, the nearer the centre point R must be to H; and the less flare, the further the centre point R must be from H; in the same proportion as you move the centre R towards, or from H, you must move the centre Y towards, or from Q, or which would be the same as spanning the dividers less, or greater, than the diameter of the end circle KL.

TO FIND THE CIRCUMFERENCE OF AN ELLIPSE.

RULE.—Multiply half the sum of the two diameters by 3.1416, and the product will be the circumference.

Example.—Suppose the longer diameter 6 inches and the shorter diameter 4 inches, then 6 added to 4 equal 10, divided by 2 equal 5, multiplied by 3.1416 equal 15.7080 inches circumference.

TO FIND THE AREA OF AN ELLIPSE.

RULE.—Multiply the longer diameter by the shorter diameter, and by .7854, and the product will be the area.

Example.—Required the area of an ellipse whose longer diameter is 6 inches and shorter diameter 4 inches?

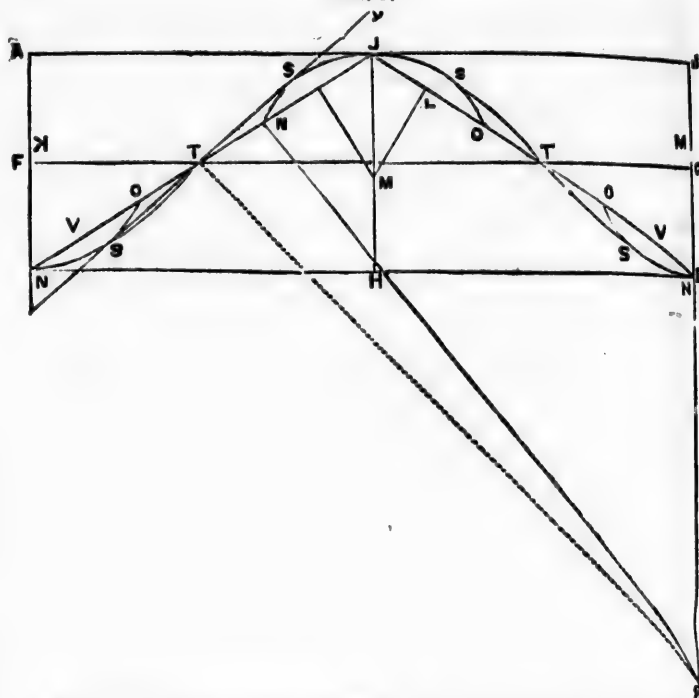
$$6 \times 4 \times .7854 = 18.8496, \text{ the area.}$$

COMPOSITION TO RESTORE BURNT STEEL.—Two parts horn filings, 10 parts tallow, 1 part sal ammoniac, 1 part pulverized charcoal, 1 part soda, pulverize the hard ingredients separately, mix all thoroughly with the tallow. Bring your burnt steel to a cherry red and dip it in the mixture; when it gets cold it may be hardened in the usual manner.

IMPROVED COLORED FIRES.—*White.* Saltpetre, 2 parts, sulphur 2 parts, antimony, 2 parts, *Red.* Nitrate of strontia, 20 parts, chlorate of potash 5 parts, sulphur 64 parts, charcoal 1 part. *Blue.* Chlorate of potash 9 parts, sulphur 3 parts, carbonate of copper 3 parts. *Yellow.* Nitrate of soda 24 parts, antimony 8 parts, sulphur 6 parts, charcoal 1 part. *Green.* Nitrate of baryta, 26 parts, chlorate of potash 18 parts, sulphur 19 parts. *Violet.* Nitrate of strontia 4 parts, chlorate of potash 9 parts, sulphur 5 parts, carbonate of copper 1 part, calomel 1 part.

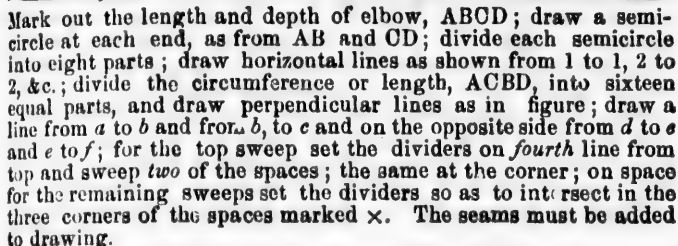
TO DESCRIBE A RIGHT ANGLED ELBOW

FIG. 5.



First construct a rectangle ADEB equal in width to the diameter of the elbow, and the length equal to the circumference; then from the point J, the middle of the line AB, draw the line JH, and from the point F, the middle of the line AD, draw the line FG; from the point J draw two diagonal lines JD and JE; then span the dividers so as to divide one of these diagonal lines into six equal parts, viz. J, L, O, T, O, V, E; from the point L erect a perpendicular, produced to the line JH, from the point of contact M, as a centre, describe the arc NJO for the top of the elbow, and from the points M M as centres, with the same sweep of the dividers, describe the arcs NO and NO; then draw an indefinite straight line PQ tangent to the arcs NO and NJ, having the points of contact at S and S; on this tangent line erect a perpendicular passing through the point N produced until it intersects the line BE produced; then place one foot of the dividers on the point of intersection R and span them over the dotted line to the point T, and with the dividers thus spanned describe the arcs TS, TS, TS, and TS; these arcs and the arcs NO, NJO, and ON will be the right angled elbow required.

FIG. 6.



[Another Method for describing a Straight Elbow.]

Fig. 8.

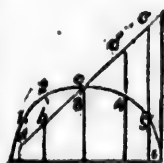
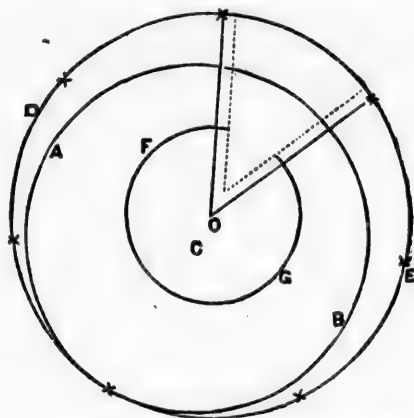


FIG. 7.—Draw a profile of half of the elbow wanted, and mark a semicircle on the line representing the diameter, divide the semicircle into six equal parts, draw perpendicular lines from each division on the circle to the angle line as on figure.

Fig. 8. Draw the circumference and depth of elbow wanted, and divide into twelve equal parts, mark the height of perpendicular lines of *Fig. 7* on *Fig. 8 a b c &c.*; set your dividers the same as for the semicircle and sweep from *e* to *e* intersecting with *f* and the same from *a* to the corner, then set the dividers one-third the circumference and sweep from *e* to *d* each side, and from *a* to *b* each side at bottom; then set your dividers three-fourths of the circumference and sweep from *c* to *d* each side on top, and from *e* to *b* at bottom, and you obtain a more correct pattern than is generally used. Allow for the lap or seam outside of your drawing, and lay out the elbow deep enough to put together by swedge or machine. Be careful in dividing and marking out, and the large end will be true without trimming. The seams must be added to drawing.

TO DESCRIBE BEVEL COVERS FOR VESSELS, OR BREASTS FOR CANS.

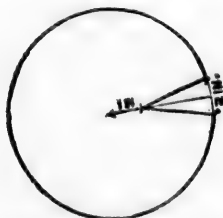
FIG. 9.



From O as a centre, describe a circle DE larger than the vessel ; and from C as a centre, describe a circle AB the size of the vessel, then with the dividers the same as you described the circle the size of the vessel, apply them six times on the circumference of the circle larger than the vessel ; for can-breasts describe the circle FG the size you wish for the opening of the breast.

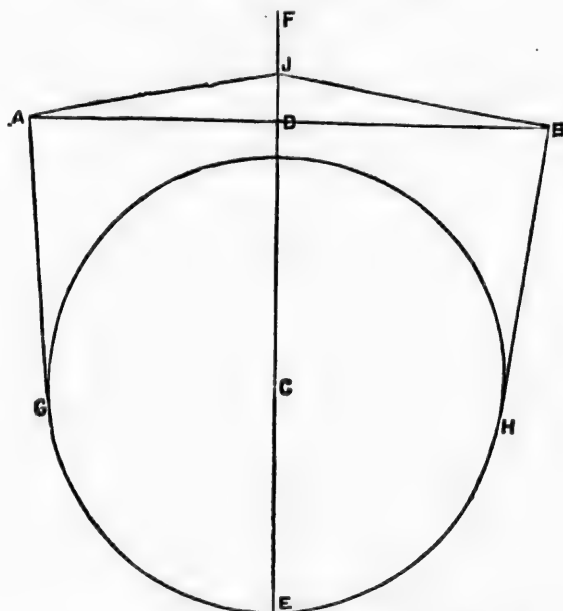
TO DESCRIBE PITCHED COVERS FOR PAILS, &C.

FIG. 10.



To cut for pitched covers, draw a circle one inch larger than the hoop is in diameter after burring, then draw a line from the centre to the circumference as in the figure, and one inch from the centre and connecting with this line draw two more lines the ends of which shall be one inch on either side of the line first drawn, and then cut out the piece.

QUICK BRIGHT DIP FOR BRASS.—Use strong nitric acid in sufficient quantity, dip your brass in the liquid for an instant, withdraw, and immediately immerse it first in cold water, then in boiling water, for a short time only in each bath, then allow it to dry. Repeat the process if necessary.

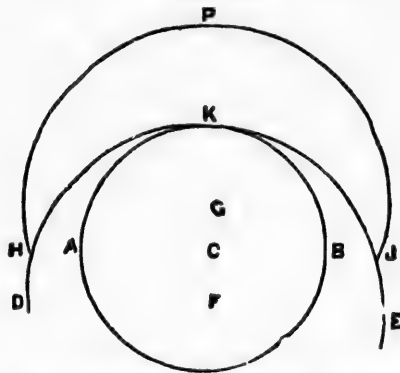
TO DESCRIBE AN OVAL BOILER COVER.
FIG. 11.

From C as a centre, describe a circle whose diameter will be equal to the width of the boiler outside of the wire, and draw the line AB perpendicular to the line EF, having it pass through the point D, which is one-half of the length of the boiler; then mark the point J one quarter of an inch or more as you wish, for the pitch of the cover, and apply the corner of the square on the line AB, allowing the blade to fall on the circle at H, and the tonage at the point J; then draw the lines HB, BJ, GA and AJ, which completes the description.

TO WELD STEEL AXLES.—To insure a good weld, prepare the composition described on page 173 for welding cast steel. Use a strong fire, and when the axle is brought to what may be termed a bright red heat, apply a sufficiency of the composition and return it to the fire until the heat is regained once more, then place it under the hammer. Be careful not to put on too much of the composition, otherwise it might waste in the fire, and by its affinity for metal obstruct the tweer iron, thereby preventing the fire from receiving the full energy of the blast, and thus retarding if not spoiling the job.

COMPRESSION OF AN INDIA-RUBBER BUFFER OF 3 INS. STROKE.

1 ton, 1.3 inch. $1\frac{1}{2}$ ton, 1 $\frac{1}{2}$ inch. 2 tons, 2 inches. 3 tons, 2 $\frac{3}{4}$ inches. 5 tons, 2 $\frac{3}{4}$ inches. 10 tons, 3 inches.

TO DESCRIBE A LIP TO A MEASURE
FIG. 12.

Let the circle AB represent the size of the measure : span the dividers from K to F three-quarters of the diameter ; describe the semicircle DKE ; move the dividers to G the width of the lip required, and describe the semicircle KPJ, which will be the lip sought.

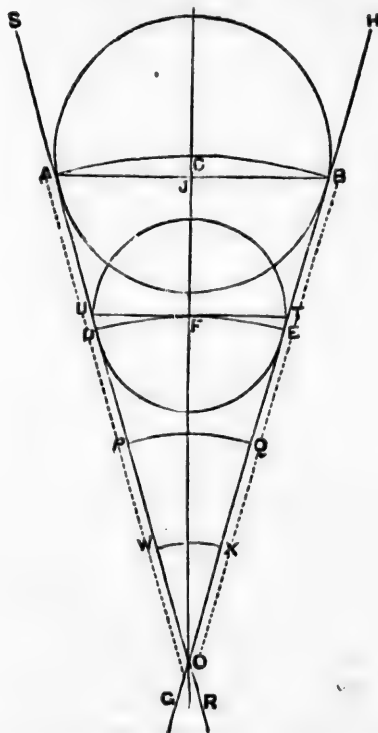
THE CIRCLE AND ITS SECTIONS.—1. The *Areas of circles* are to each other as the squares of their diameters ; any circle twice the diameter of another contains four times the area of the other. 2. The *Radius* of a circle is a straight line drawn from the centre to the circumference. 3. The *Diameter* of a circle is a straight line drawn through the centre, and terminated both ways at the circumference. 4. A *Chord* is a straight line joining any two points of the circumference. 5. An *Arc* is any part of the circumference. 6. A *Semicircle* is half the circumference cut off by a diameter. 7. A *Segment* is any part of a circle cut off by a chord. 8. A *Sector* is any part of a circle cut off by two radii.

SPRINGS.—The flexure of a spring is proportional to its load and to the cube of its length. A railway carriage spring, consisting of 10 plates 5-16 inch thick and 2 of 3-8 inch, length 2 feet 8 ins., width 3 ins., and *camber* or spring 6 ins. ; deflected as follows, without any permanent set. $\frac{1}{2}$ ton, $\frac{1}{2}$ inch. 1 ton, 1 inch. $1\frac{1}{2}$ ton, $1\frac{1}{2}$ inch. 2 tons, 2 inches, 3 tons, 3 inches. 4 tons, 4 inches.

DIFFERENT STYLES OF FILING.—To file a surface true, it is necessary on commencing to squeeze the file tightly between the third and fourth fingers and palm of your hands until you become used to it. Your position in filing should be half left face to your work, with the middle of your right foot fifteen inches behind your left heel ; and to file your work true or square, it is necessary to reverse your work often as by this means you are enabled to see the whole surface you are filing, and see while filing whether you are filing true or not. When, however, your work is so heavy that you cannot reverse it you had better file first to the right and then to the left, as by this means you can plainly see the file marks, and this again assists you in filing true.

TO DESCRIBE A FLARING VESSEL PATTERN, A SET OF PATTERNS FOR A PYRAMID CAKE, OR AN ENVELOPE FOR A CONE.

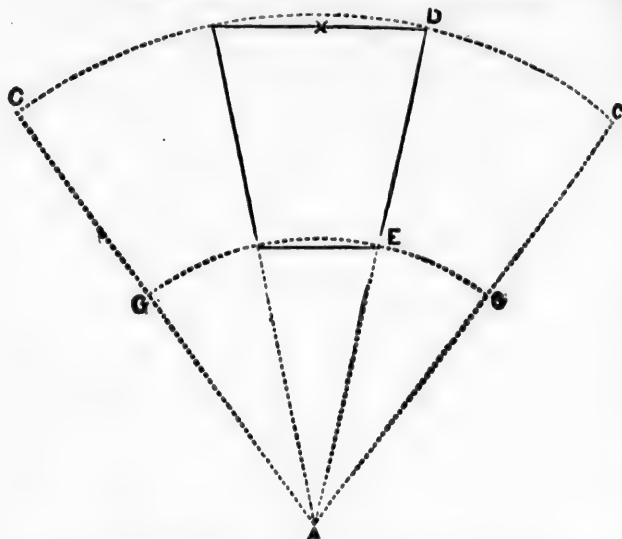
FIG. 13.



From a point C as a centre, describe a circle AB equal to the large circumference ; with the point F as a centre, the depth of the vessel, describe a circle DE equal to the small circumference ; then draw the lines GH and RS tangent to the circles AB and DE; from the point of intersection O as a centre, describe the arcs ACB and DFE ; then ADEB will be the size of the vessel, and three such pieces will be an envelope for it, and AJBTFU the altitude ; then dividing the sector SOH into sections AB, DE, PQ, and WX, you will have a set of patterns for a pyramid cake ; and the sector AOB will be one-third of an envelope for a cone.

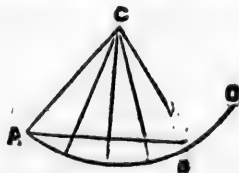
In allowing for locks, you must draw the lines parallel to the radii, as represented in the diagram by dotted lines, which will bring the vessel true across the top and bottom.

TO DESCRIBE A CONE OR FRUSTUM.—FIG. 14.



First draw a side elevation of the desired vessel, DE, then from A as a centre describe the arcs CDC and GEG; after finding the diameter of the top or large end, turn to a table of Diameters and Circumferences, where you will find the true circumference, which you will proceed to lay out on the upper or larger arc CDC, making due allowance for the locks, wire and burr. This is for one piece; if for two pieces you will lay out only one-half the circumference on the plate; if for three pieces one-third; if for four pieces one-fourth; and so on for any number, remembering to make the allowance for locks, wire and burr on the piece you use for a pattern.

RULE FOR STRIKING OUT A CONE OR FRUSTUM.—FIG. 22.

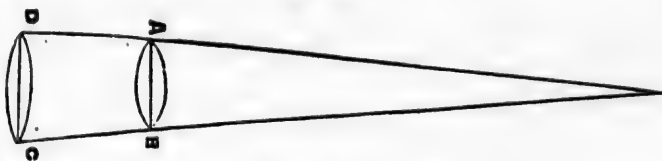


In a conical surface, there may be economy, sometimes, in having the slant height 6 times the radius of base. For a circle may be wholly cut into conical surfaces, if the angle is 60° , 30° , 15° , &c.

But there is a greater simplicity in cutting it, when the angle is 60° . For instance, take AC equal to the slant height, describe an indefinite arc AO; with the same opening of the dividers measure

from A to B; draw BC and we have the required sector. This would make the angle C equal 60°. This angle may be divided into two or four equal parts, and we should thus have sectors whose angle would be 30°, or which would not make the vessel very flaring. The accompanying figure gives about the shape of the flaring.

FIG. 16.



ring vessel when the angle of the sector is 30°.

TO FIND THE CONTENTS OF A PYRAMID OR CONE.

RULE.—Multiply the area of the base by the height, and one-third of the product will be the solid content.

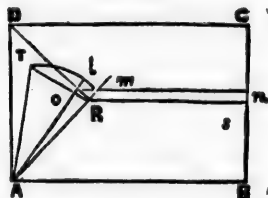
EXAMPLE.—Required the solid content in inches of a Cone or Pyramid, the diameter of the base being 8 inches, and perpendicular height 18 inches?

$8 \times 8 = 64 \times .7854 \times 18 = 904.7808 \div 3 = 301.5936$ inches $\times 231 = 1$ gall. $1\frac{1}{4}$ qts

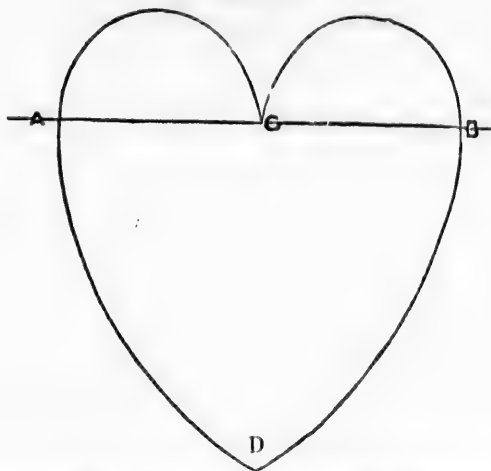
HIPPED ROOFS, MILL HOPPERS, &C.

To find the various Angles and proper Dimensions of Materials whereby to construct any figure whose form is the Frustum of a proper or inverted Pyramid, as Hipped Roofs, Mill Hoppers, &c.

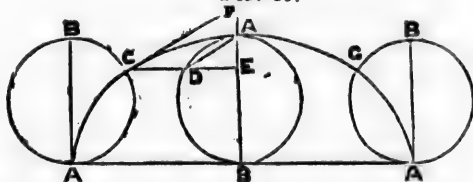
FIG. 17.



Let ABCD be the given dimensions of plan for a roof, the height RT also being given; draw the diagonal AR, meeting the top or ridge Rs on plan; from R, at right angles with AR and equal to the required height, draw the line RT then TA, equal the length of the struts or corners of the roof; from A, with the distance AT, describe an arc Tl, continue the diagonal AR until it cuts the arc Tl, through which, and parallel with the ridge Rs, draw the line m n, which determines the required breadth for each side of the roof: from A, meeting the line m n, draw the line A o, or proper angle for the end of each board by which the roof might require to be covered; and the angle at T is what the boards require to be made in the direction of their thickness, when the corners or angles require to be mitred.

TO DESCRIBE A HEART.
FIG. 18.


Draw an indefinite line AB; then span the dividers one-fourth the width you wish the heart, and describe two semicircumferences AC and CB; span the dividers from A to B, the width of the heart, and describe the lines AD and BD, which completes the description.

CYCLOID.
FIG. 19.


Cycloid, a curve much used in mechanics. It is thus formed:—

If the circumference of a circle be rolled on a right line, beginning at any point A, and continued till the same point A arrive at the line again, making just one revolution, and thereby measuring out a straight line ABA equal to the circumference of a circle, while the point A in the circumference traces out a curve line ACAGA; then this curve is called a cycloid; and some of its properties are contained in the following lemma.

If the generating or revolving circle be placed in the middle of the cycloid, its diameter coinciding with the axis AB, and from any point there be drawn the tangent CF, the ordinate CDE perpendicular to the axis and the chord of the circle AD; then the chief properties are these:

The right line CD equal to the circular arc AD;

The cycloidal arc AC equal to double the chord AD;

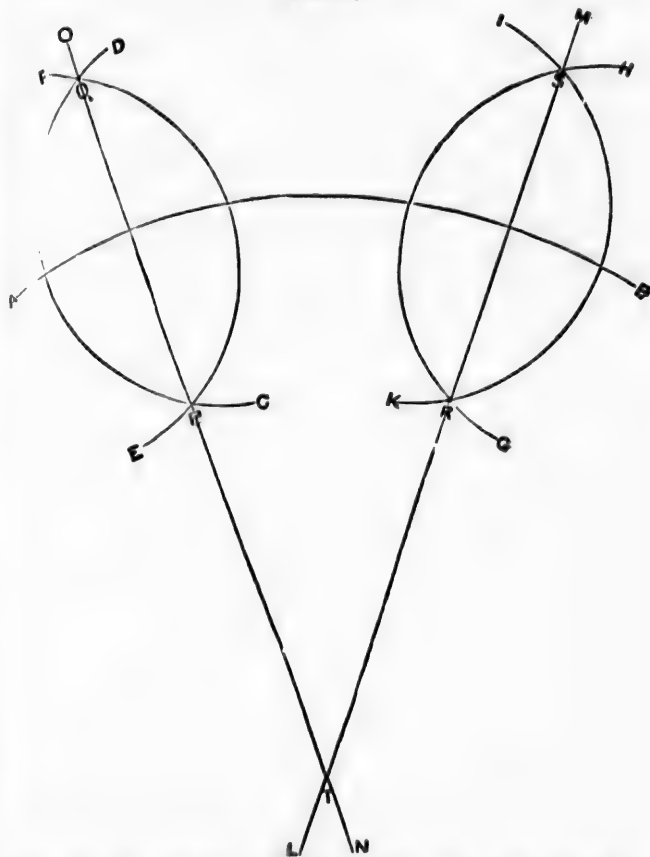
The semi-cycloid ACA equal to double the diameter AB, and

The tangent CF is parallel to the chord AD.

This curve is the line of swiftest descent, and that best suited for the path of the ball of a pendulum.

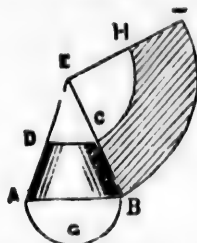
13 FIND THE CENTRE OF A CIRCLE FROM A PART OF THE CIRCUMFERENCE.

FIG. 20.



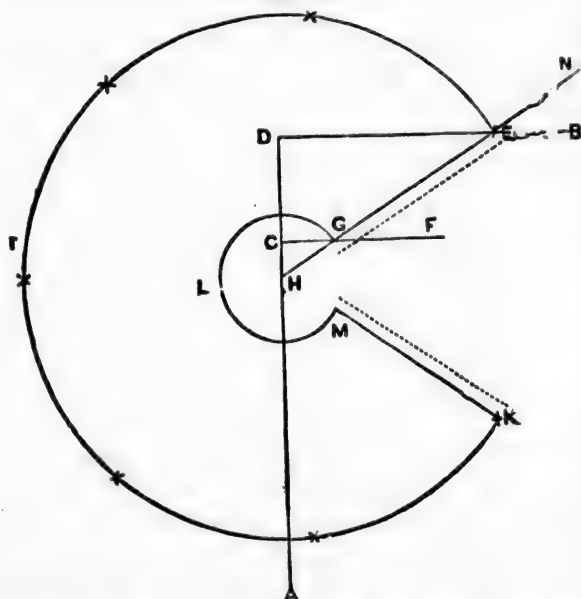
Span the dividers any distance you wish, and place one foot on the circumference AB, and describe the semicircles CD, E F, G H, and I K, and through the points of their intersection PQ and RS, draw two indefinite lines LM and NO; the point of their intersection T, will be the centre desired.

TO CONSTRUCT THE FRUSTUM OF A CONE.
Form of flat Plate by which to construct any Frustum of a Cone.
 FIG. 21.



Let ABCD represent the required frustum; continue the lines AD and BC until they meet at E; then from E as a centre, with the radius EC, describe the arc CH; also from E, with the radius EB, describe the arc BI; make BI equal in length to twice AGB, draw the line EI, and BCHE is the form of the plate as required.

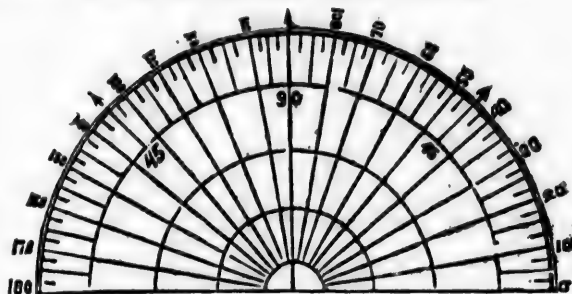
TO DESCRIBE BEVEL COVERS FOR VESSELS, OR BREASTS FOR CANS.
 FIG. 22.



Construct a right angle ADB, and from the point C, the altitude height you wish the breast, erect a perpendicular line F; then on the line B, mark the point E one-half the diameter of the can and

on the line F, mark the point G one-half the diameter of the opening in the top of breast; draw a line N to pass through the points E and G produced until it intersects the line A; place one foot of the dividers at the point of intersection H, and place the other on the point E, and describe the circle EIK; span the dividers from the point H to point G, and describe the circle GLM; then span the dividers from the point D to E, and step them six times on the circle EIK, which gives the size of the breast. Remember to mark the lines for the locks parallel with the radii.

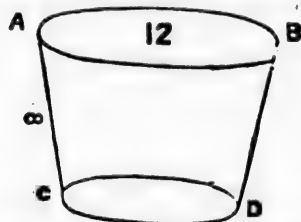
SECTOR, FOR OBTAINING ANGLES.—FIG. 23.



Sector, a portion of a circle comprehended between any two radii and their intercepted arcs.—*similar sectors* are those whose radii include equal angles.

To find the area of a sector. Say as 360° is to the degrees &c., in the arc of the sector, so is the area of the whole circle to the area of the sector. Or multiply the radius by the length of the arc, and half the product will be the area.

TO STRIKE THE SIDE OF A FLARING VESSEL.—FIG. 24.



To find the radius of a circle for striking the side of a flaring vessel having the diameters and depth of side given.

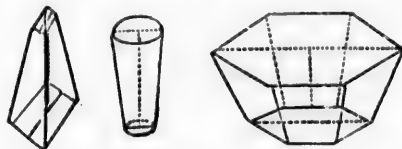
RULE.—As the difference between the large and small diameter is to the depth of the side, so is the small diameter to the radius of the circle by which it is struck.

Example.—Suppose ABCD to be the desired vessel, with a top diameter of 12 inches, bottom diameter 9 inches, depth of side 8 inches. Then as $12 - 9 = 3 : 8 :: 9$ to the radius.

$$8 \times 9 = 72 \div 3 = 24 \text{ inches answer.}$$

CONTENTS IN GALLONS OF THE FRUSTRUM OF A CONE.

Figs. 25, 26, 27.



To find the contents in gallons of a vessel whose diameter is larger at one end than the other, such as a Bowel, Pail, Firkin, Tub, Coffee-pot, &c.

RULE.—Multiply the larger diameter by the smaller, and to the product add one-third of the square of their difference, multiply by the height and multiply that product by .0034 for Wine Gallons, and by .002785 for Beer.

EXAMPLE.—Required the contents of a Coffee-pot 6 inches diameter at the top, 9 inches at the bottom, and 18 inches high.

large diameter	9	brought up	1026
small do	6		.0034
	54		4104
$\frac{1}{2}$ of the square	3		3078
	57		
height	18		
	456		
	57		
Carried up	1026		

3.4884 Wine Gallons,
or nearly $3\frac{1}{4}$ gallons.

1026 multiplied by .002785 equal 2.8574 Beer Gallons.

MAKING DIES FOR SCREW-CUTTING.—In making dies for screw-cutting, they should, whenever practicable, be lipped with a taper tap, as they cut more easily and wear longer than those which are cut straight, and then tapered off to make the screw "take."

Very fine threaded screws, however, cut well with straight dies. Small dies, or dies below one-fourth of an inch in size, should only have three lips in them. Dies from one-fourth to one half should have four lips in them. Dies from three-fourths to one inch should have six lips in them; and dies from one inch to one and a half should have seven lips in them. The cuts through dies should be only twice the depth of the thread which is sufficient to make them free themselves from chips, for when cut too deep they are liable to break on the face. Harden and draw to a straw color.

TO DIP A FLUTED REAMER PROPERLY.—Dip it perpendicularly to a short distance beyond the fluting—that is to say, about half an inch and withdraw and return it several times. This hardens the lips, and prevents it cracking off at the water's edge, which is the case when a piece of steel is dipped in to a certain depth, and allowed to cool without moving.

FILING
possible
rapidly,
a straight
part of
the teeth
same time
the contents
rattle with
If one tooth
each side
cutting
the saw
one too
do not
cross cut
old file,
careless
that it
teeth sh
greatest
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FILING SAWS.—The grand secret of putting any saw in the best possible order, consists in filing the teeth at a given angle to cut rapidly, and of a uniform length so that the points will all touch a straight edged rule without showing a variation of the hundredth part of an inch. Besides this, there should be just set enough in the teeth to cut a kerf as narrow as it can be made, and at the same time allow the blade to work freely without pinching. On the contrary, the kerf must not be so wide as to permit the blade to rattle when in motion. The very points of the teeth do the cutting. If one tooth is a twentieth of an inch longer than two or three on each side of it, the long tooth will be required to do so much more cutting than it should, that the sawing cannot be done well, hence the saw goes jumping along, working hard and cutting slowly; if one tooth is longer than those on either side of it, the short teeth do not cut although their points may be sharp. When putting a cross cut saw in order, it will pay well to dress the points with an old file, and afterwards sharpen them with a fine whetstone, much mechanical skill is necessary to put a saw in prime order, one careless thrust with a file will shorten the point of a tooth so much that it will be utterly useless, so far as cutting is concerned; the teeth should be set with much care, and the filing done with the greatest accuracy. If the teeth are uneven at the points, a large flat file should be secured to a block of wood in such a manner that the very points only may be jointed, so that the cutting edge of the same may be in a straight line, or circle, if it is a circular saw; every tooth should cut a little as the saw is worked. The teeth of a hand saw for all kinds of work should be filed fleaming, or at an angle on the front edge, while the back edges may be filed fleaming, or square across the blade. The best way to file a circular saw for cutting wood across the grain, is to dress every fifth tooth square across, and apart one twentieth of an inch shorter than the others, which should be filed fleaming at an angle of about forty degrees.

As regards such saws as are used for cutting up large logs into lumber it is of the utmost importance to have them filed at such an angle as will ensure the largest amount of work with the least expenditure of power. The following diagrams will help to illustrate our meaning. Fig. 1. shows the shape of teeth which nearly all ex-



FIG. 1.

perienced mill-men consider as that standard form which combines the greatest amount of strength and capacity for rapid work, with the minimum of driving power while doing the work.

Figure No. 2 represents a passable form of teeth which are capable of doing a good deal of work, but their great weakness lies in their slender points. Look out for "breakers" when teeth of this description are passing through dry spruce or hemlock knots,



FIG. 2.

Fig. No. 3 illustrates the appearance of one of those intolerable wood rasps which are altogether too common in saw-mills. Only think what an appalling waste of valuable power is required to drive a "jigger" like this through a large log!



FIG. 3.

Fig. 4, at α , is intended to show the method of ascertaining the proper angle, that of sixty degrees, at which such saws *should* be filed. The diagram being self-explanatory requires but little further elucidation here. A quarter circle with lines radiating from the centre towards the circumference is represented near the verge of the segment of a circular saw. The lower part corresponds with the level of the horizon, and the higher part at 90° corresponds

with the zenith or meridian, where the sun appears at noon-day. Exactly half-way up is 45° ; look up a little higher and you will find 60° indicated by the radiating line which runs parallel with the angle of the tooth of the saw and this is the guide you must follow in filing. The same rule is seen applied to a straight mill saw at *b*.

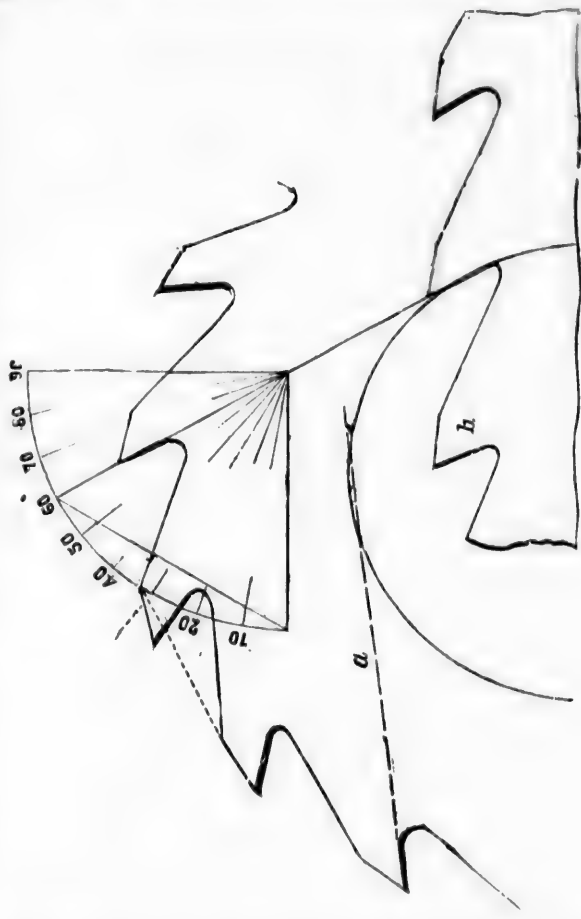


FIG. 4.

Many good authorities contend that mill saws should in on case be set with the instrument commonly used for that purpose, but

that in lieu thereof the teeth should be spread out at the points with the swage or upset to a sufficient extent to permit the body of the saw to operate without binding. Both instruments require to be skilfully handled, and the swage, when used in this way, has proved itself equal to every emergency without the risk of breaking the teeth. It would be quite safe to say that the saw-set should only be used on saws of this description with the most extreme caution and care. Every manufacturer, however, has his own opinion, and consequent practice on the subject, some contending that one way is right and the other directly the reverse.

TO REPAIR FRACTURED CIRCULAR SAWS.—The best way to do this is to drill a small round hole at the termination of the crack, which effectually prevents its further extension. I have seen some circular saws very neatly repaired by riveting thin clamps to each side of the fracture, both clamps and rivets being countersunk so they will be level with the surface of the saw, and placed in such a position across the crack as to impart the greatest possible strength to the weakest place. A table of the speed of circular saws can be seen at page 169, this, however, does not embrace the velocity of shingle machine saws, which ought to make at least 1400 revolutions per minute.

TO MEND BROKEN CROSS CUT SAWS.—In the first place scarf off the broken edges in such a manner that when lapped over each other they will be about the same thickness as the rest of the plate, and rivet them together loosely with iron rivets inserted through holes which must be punched for that purpose; the ends must be united with great accuracy so that the teeth, &c., of the saw may range truly. Now place the saw in the fire, then a flux of powdered borax and sal ammoniac is flowed all over it after having it raised to the proper heat. See page 173 for preparing and using the composition. Return the saw to the fire and when it is raised to the proper welding heat, place it on the anvil and unite the joint as rapidly as possible with the hammer; be careful not to heat so hot as to injure the steel. When the job is well done, and the part properly tempered, it will be found as strong as the rest of the plate. I know one blacksmith in Canada who told me that this class of work was the best paying part of his business.

POWER OF ENGINES.—Horse-power in steam engines is calculated as the power which would raise 33,000 lbs. a foot high in a minute, or 90 lbs. at the rate of 4 miles an hour. One horse-power is equal to the lifting, by a pump, of 250 hogsheds of water ten feet in an hour. Or it would drive 100 spindles of cotton yarn twist, or 500 spindles of No. 48 mule yarn, or 1000 of No. 110, or 12 power looms. One horse-power is produced by 19 lbs. of Newcastle coals, 50 lbs. of wood, or 34 lbs. of culm. Coals 1, wood 3, and culm 2, give equal heats in the production of steam.

Sixteen lbs. of Newcastle coal converts 100 lbs. of water into steam. A bushel of coal per hour raises steam to 15 lbs. the square inch, whose velocity is 1350 feet per second, and 2 bushels raise it to 120 lbs., or velocity of 3800 feet per second. A horse-power requires from 5 to 7 gallons of water per minute for condensation of steam. A steam engine whose cylinder is 31 inches, with

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17 double strokes per minute, performs the constant work of 40 horses with 5 tons of coal per day. One of 19 inches and 25 strokes of 12 horses, with $1\frac{1}{2}$ tons per day. They raise 20,000 cubic feet of water 24 feet for every hundred weight of coals. One bushel of good coals raises from 24 to 32,000,000 lbs. one foot per minute. Four bushel of coals per hour, with a cylinder of 31 $\frac{1}{2}$ inches and 17 $\frac{1}{2}$ strokes of 7 feet per minute, is a force equal to 40 horses constantly. A rotative double engine, with a cylinder of 23.75 inches, making 21.5 strokes of 5 feet per minute, is a 20 horse-power; and a cylinder of 17.5, making 25 strokes of 4 feet is a 10 horse-power; the consumption of coals being proportional.

ON STEAM BOILERS.—Regarding the steam engine as under Providence, one of the most powerful civilizing agents in existence, and the procuring cause of the bread of many thousands of our fellow-beings, it seems highly proper to place on record some well-known facts regarding boiler construction and the properties of steam, &c., in order that such knowledge may be used to mitigate the number of those lamentable accidents which, in too many cases, owe their origin to ignorance and incapacity. Regarding the form of boilers, it is now an ascertained fact that the maximum strength is obtained by adopting the cylindrical or circular form, the huycock, hemispherical, and waggon-shaped boilers, so general at one time, have now deservedly gone almost out of use. Good boiler plate is capable of with-standing a tensile strain of 50,000 lbs. or 60,000 lbs. on every square inch of section; but it will only bear a third of this strain without permanent derangement of structure, and 4000 lbs., or 3000 lbs. even, upon the square inch, is a preferable proportion. It has been found that the tenacity of boiler-plate increases with the temperature up to 570°, at which point the tenacity commences to diminish. At 32° the cohesive force of a square inch of section was 56,000 lbs.; at 570° it was 66,500 lbs.; at 720°, 55,000 lbs.; at 1050°, 32,000 lbs.; at 1240°, 22,000 lbs.; and at 1317°, 9,000 lbs. Strips of iron, when cut in the direction of the fibre, were found by experiment to be 6 per cent. stronger than when cut across the grain. The strength of riveted joints has also been demonstrated by tearing them directly asunder. In two different kinds of joints, double and single riveted, the strength was found to be, in the ratio of the plate, as the numbers 100, 70, and 56.

Assuming the strength of the plate to be	100
The strength of a double riveted joint would be, after allowing for the adhesion of the surfaces of the plate.....	70
And the strength of a single riveted joint.....	56

These figures, representing the relative strengths of plates and joints in vessels required to be steam and water tight, may be safely relied on as perfectly correct. The accidental overheating of a boiler has been found to reduce the ultimate or maximum strength of the plates from 65,000 to 45,000 lbs. per square inch of section. The greatest caution should be exercised against low water and incrustations in the boiler, for, in that case, the plates over the furnace are apt to get red hot, and, when in this state, they have lost five-sixths of their strength, and there is then danger of

bursting the boiler, even at the common working pressure, as a force of less than one-sixth of the usual strength of the plates will be found sufficient to do so. To let in a great body of water on the incandescent plates at such a time only increases the danger, by suddenly generating a large volume of highly elastic steam. The proper way, during such emergency, is not to draw the fires, for then there is no time for that, but to open the furnace doors and dash in a few bucketsful of water upon the fire, and blow off the steam as rapidly as possible. Every description of boiler used in manufactories or on board of steamers should be constructed to a bursting pressure of 400 to 500 lbs. on the square inch; and locomotive engine boilers, which are subject to much harder duty, to a bursting pressure of 600 to 700 lbs. Such boilers are usually worked at 80 to 100 lbs. on the inch, but are frequently worked up to a pressure of 120, and, when rising steep grades, sometimes even as high as 200 lbs. to the square inch. In a boiler subject to such an enormous working pressure, it requires the utmost care and attention on the part of the engineer to satisfy himself that the flat surfaces of the fire box are capable of resisting that pressure, and that every part of the boiler is so nearly balanced in its powers of resistance as that, when one part is at the point of rupture, every other part is at the point of yielding to the same uniform force; for we find that, taking a locomotive boiler of the usual size, even with a pressure of 100 lbs. on the square inch, it retains an expanding force within its interior of nearly 60,000 tons, which is rather increased than diminished at a high speed. To show the strain upon a high-pressure boiler, 30 feet long, 6 feet diameter, having 2 centre flues, each 2 feet 3 inches diameter, working at a pressure of 50 lbs. on the square inch, we have only to multiply the number of the square feet of surface, 1030, exposed to pressure, by 321, and we have the force of 3319 tons, which such a boiler has to sustain. To go farther, and estimate the pressure at 450 lbs. on the square inch, which a well-constructed boiler of this size will bear before it bursts, and we have the enormous force of 29,871, or nearly 30,000 tons, bottled up within a cylinder 30 feet long and 6 feet diameter. Boilers in actual use should be tested at least once a year, by forcing water into them by the hand feed-pump, until the safety-valve is lifted, which should be loaded with at least twice the working pressure for the occasion. If a boiler will not stand this pressure it is not safe, and either its strength should be increased or the working pressure should be diminished. Internal flues, such as contain the furnace in the interior of the boiler, should be kept as near as possible to the cylindrical form; and, as wrought iron will yield to a force tending to crush it about one-half of what would tear it asunder, the flues should in no case exceed one-half the diameter of the boiler, with the same thickness of plates they may be considered equally safe with the other parts. The force of compression being so different from that of tension, greater safety would be ensured if the diameter of the internal flues were in the ratio 1 to 2½ instead of 1 to 3 of the diameter of the boiler. As regards the relative size and strength of flues, it may be stated that a circular flue 18 inches in diameter will resist

pressure, as a the plates will f water on the he danger, by e steam. The the fires, for ace doors and blow off the boiler used in constructed to uch; and loco- order duty, to a s are usually ntly worked up sometimes even subject to such most cure and elf that the flat e pressure, and n its powers of rapture, every iform force; for he usual size, inch, it retains 000 tons, which . To show the 5 feet diameter, r, working at a nly to multiply used to pressure. uch a boiler has re at 450 lbs. on of this size will ce of 29,871, or feet long and 6 ed at least once eed-pump, until d with at least boiler will not ngth should be shed. Internal e of the boiler, al form; and, as h it about one- uld in no case same thickness the other parts. that of tension, of the internal the diameter of ngth of flues, it eter will resist

double the pressure of one 3 feet in diameter. Mill owners, with plenty of room and a limited experience with steam power, would do well to dispense with boilers containing many flues, the expense is greater and the durability less than where there is two or three only. The foam caused by a large number of flues is apt to deceive an inexperienced engineer, causing him to believe that there is plenty of water in the boiler when he tries the gauge cock, when there is really but very little, often causing an explosion. Some mill-owners insert a fusible plug in the crown of the furnace to indicate danger from low water. As common lead melts at 620° , a rivet of this metal, 1 inch in diameter, inserted immediately over the fire place, will give due notice, so that relief may be obtained before the internal pressure of the steam exceeds that of the resisting power of the heated plates. In France, an extensive use is made of fusible metal plates, generally covered by a perforated metallic disk, which protects the alloy of which the plate is composed, and allows it to ooze through as soon as the steam has attained the temperature necessary to insure the fusion of the plate, which varies from 289° to 350° . The reader will find a number of such alloys under the tabular view of alloys and their melting heats, page 243. Another method is the bursting plate, fixed in a frame and attached to some convenient part of the upper side of the boiler, of such thickness and ductility as to cause rupture when the pressure exceeds that on the safety valve. But, beyond all question, constant use should be made on all boilers of a good and reliable system of steam gauges, glass tubes, gauge cocks, safety valves, &c. By means of the glass tubes affixed to the fronts of the boilers, the height of the water within the boiler is indicated at once, for the water will stand at the same height in the tube that it stands in the boiler, communication being established with the water below and the steam above, by means of stop cocks. The gauge cocks are cocks penetrating the boiler at different heights, and which, when opened, tell whether it is water or steam that exists at the level at which they are respectively inserted. The average level of the water in the boiler should be above the centre of the tube, and the lowest of the gauge cocks should always run water, and the highest blow steam. The steam gauge indicates the pressure of steam by a hand on a dial. It sometimes happens that the glass tube gets choked up, and, to correct this, the cocks connecting the tube with the boiler should be so constructed that the tube may be blown through with the steam, to remove any obstacle that may interfere with its use. By blowing off the boiler frequently, a large amount of calcareous, and, on ocean vessels, saline matter, will be got rid of, which otherwise would cause trouble and perplexity by forming incrustations and deposits on the boiler, and which interferes most seriously with the transmission of the heat from the boiler plates to the water. In many cases the plates get red hot, causing the scale to crumble; the water thus suddenly admitted to the highly heated surface is at once transformed into highly rarefied steam, and the boiler is bursted. Too much caution cannot be exercised to see that the safety valve is properly loaded and that no impediment exists to impair its free action, and that all the other apertures, valves, &c., belonging to the boiler are in good

working order, but be specially particular that the care and management of the whole is entrusted to a person well recommended for caution and intelligence in his profession. No fact is better ascertained than that the great majority of boiler explosions have resulted from the employment of ignorant and incapable practitioners, who, being utterly oblivious to all sense of danger on their own account, cannot be expected to care for the safety of others. For cements for Steam Boilers, &c., see page 182. For preventing incrustation, see page 189, to which I will here add that Irish moss is also a good preventive of scale. Regarding the power of boilers, it may be stated that a boiler 30 feet long and 3 feet in diameter, will afford $30 \times 3 \times 3.14 \times 2 = 141.30$ square feet of surface, or steam for 14 horse-power, if 10 feet are assumed for one horse-power. Two short boilers are preferable to one long one, on account of having more fire surface,—it being always necessary to have as much fire surface as possible to make the best use of the fuel—as the hotter the surface is kept, the less fuel it takes to do the same amount of work. In some localities, such as the lumbering territory of New-Brunswick, it would be no economy to save fuel, many of the mills driven by water being put to a heavy expense in removing and burning off the debris. When there is a large furnace it gives the fireman a better chance to keep the steam regular, for when clearing out one part of the furnace, he can keep a hot fire in the other. For each horse-power of the engine there ought to be at least one square foot of grate, and three feet would be better. In setting a boiler, arrangement should be made to carry on combustion with the greatest possible heat. This requires good non-conductors of heat, such as brick, with which to surround the fire. If these bricks are of a white color, the combustion is more perfect than if of a dark color. The roof, as well as the sides, of the furnace should be of white fire-brick. The bars of the furnace should be 18 or 20 inches below the boiler or crown of the furnace. The fire should be kept open and thin, and frequently and sparingly supplied, to allow the air to enter between the bars, for the better consumption of the inflammable gases. The bars should slope downward toward the back part, about half an inch to the foot. The ashes should be often cleaned out, and not suffered to accumulate, otherwise it will stop the draft, burn out the bars, and take more fuel. A crack in a boiler plate may be closed by boring holes in the direction of the crack and inserting rivets with large heads, so as to cover up the imperfection. If the top of the furnace be bent down, from the boiler having been accidentally allowed to get short of water, it may be set up again by a screw-jack, a fire of wood having been previously made beneath the injured plate; but it will in general be nearly as expeditious a course to remove the plate and introduce a new one, and the result will be more satisfactory. There is one object that requires very particular attention, and which must be of a certain size to produce the best effect, and that is the flue leading from the boiler to the chimney, as well as the size and elevation of the chimney itself. Every chimney should be built several feet above the mill house, so that there is no obstruction to break the air from the top of the chimney. In England a factory chimney suitable for a 20 horse-

power boiler is commonly made about 20 inches square inside, and 80 feet high, and these dimensions are correct for consumption of 15 lbs. coal per horse-power per hour, a common consumption for factory engines. In the Dominion of Canada and the United States, chimneys of plate iron, from 30 to 50 feet high, are in quite common use by owners of saw, and other mills, and they seem to answer every requirement.

COMPOSITION FOR COVERING BOILERS, &C.—Road scrapings, free from stones, 2 parts; cow manure, gathered from the pasture, 1 part; mix thoroughly, and add to each barrowful of the mixture 6 lbs. of fire clay; $\frac{1}{2}$ lb. of flax shoves or chopped hay, and 4 ozs. teased hair. It must be well mixed and chopped; then add as much water as will bring it to the consistency of mortar,—the more it is worked the tougher it is. It may either be put on with the trowel or daubed on with the hand, the first coat about 1 inch thick. When thoroughly dry, another, the same thickness, and so on, three inches is quite enough, but the more the better. Let each coat be scored like plaster, to prevent cracks, the last coat light and smooth, so as to receive paint, whitewash, &c. The boiler, or pipes, must first be brushed with a thin wash of the mixture to ensure a catch.

RULE FOR SIZE OF CYLINDER.—The requisite diameter of cylinder for a 25 horse beam engine is 28 inches, and about 5 feet stroke. The nominal horse-power of any sized cylinder can be found by the following formula:—For low pressure or beam engines, divide the area of cylinder by 25, which will give the number of horse-power. For high pressure horizontal engines divide the area of cylinder's diameter by 12.5, which will give the number of horse-power, including all friction.

STROKE OF ENGINES.—The stroke of an engine varies according to circumstances, which the designer must take into consideration, but the general rule is to make the stroke about twice the diameter of the cylinder. The diameter of the fly wheel should be about 4 times the stroke of the engine, and the rim should weigh about 3 cwt. per horse power.

BALANCE WHEEL.—Every balance wheel should be speeded up so as to run twice or three times as fast as the crank shaft it is intended to balance. When a balance wheel is applied in this way it makes the machine run a great deal more steadily, for, when the balance wheel is geared into the crank shaft, and runs two or three times faster than the crank shaft, it forms a power of itself, when going over the centre which propels the crank shaft until it reaches the quarter where it again takes its power from the machine. Although it takes an additional shaft and gears to apply a balance wheel in this way, the saving of metal in the balance wheel fully compensates for the extra labour, for, when a balance wheel is speeded three times as fast as the crank shaft, it needs only one third of the metal in it that it would were it not speeded up at all, and if balance wheels were applied in this way generally it would make all engines run far more steadily.

TO SET A GUTTEN SHAFTING.—This should be done by centreing, then set it into a lathe, and square the ends up with what is called a side tool. After doing this, take a piece of chalk and try it in

several places, to find out where the worst crooks are: then, if you have not a machine for springing shafting, spring it with a lever where the most crook is, and continue this operation till the shaft is straight.

TURNING SHAFTING.—To do this properly, two chips should always be run over the shaft, for the reason that it saves filing and leaves the shaft truer and more round, and on shafts thus turned, the time saved in filing more than compensates for the time lost in turning. Before you commence you will put your feed belts or gear on a coarse feed; turn off one a sixty-fourth of an inch larger than the size required; having turned off this chip, commence the finishing chip, and turn it small enough to have the pulley wring on about an inch without filing. This will leave it large enough to file and finish. If there are couplings to go on a shaft, with holes smaller than the holes in the pulleys, the ends of the shaft, where they fit on, should be turned down to a sixty-fourth of an inch of the size required before any part of the shaft is finished; that is, every part of a shaft should be turned to within a sixty-fourth of an inch of the size required before any part if it has the finish-chip taken off. The reason for that is that it leaves every part of the shaft perfectly true, which would not be the case were it done otherwise. Having done this, you will file the shaft so that the pulleys will slide on, and the couplings so that they will drive on; polish the shaft with a pair of polishing-clamps and some emery and it is done.

WORKING STEEL FOR TOOLS.—In working steel for tools, great care should be taken to hammer all sides alike, for if one side is hammered more than another it will cause it to spring in hardening. Again, steel, when being hammered, should be heated as hot as it will stand, until finishing and should then be hammered until almost black hot, for the reason that it sets the grain finer, and gives the tool a better edge. The reason for heating the steel so hot while hammering is simply because it makes the steel tougher when hardened, and softer when annealed; while, if it were worked at a low red heat, the continued percussive shocks of the hammer would so harden it as to make it almost impossible to anneal it, and at the same time render it brittle when hardened.

TEMPERING TOOLS.—Drawing the temper of tools is usually done in a charcoal flame, and to draw the temper of a tool properly it should be held in the thickest part, or the part not requiring any temper towards the fire, and in the meantime, should be often wiped with a piece of waste or rag, dipped in oil. The oil keeps the temper even, and prevents it drawing more to one place than another. And in drawing the temper of any tool it should be drawn very slowly, otherwise it will run too far ere you are aware of it. Lancet blades and razors should be drawn to a straw color. Knife blades and chisels should be drawn to a copper or almost red color. Plane irons, shaving knives and shoemakers knives the same temper; cold chisels and stone drills, should be drawn to a dark blue. Fluted reamers should only be drawn to a straw color, on the end, as they never break elsewhere, and keep their size longer by leaving the lips hard. Half round or tapering reamers, also taps, dies, and drills, should be drawn to a straw

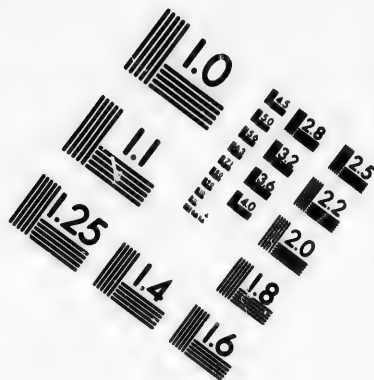
solor. Jijacs and gauges, also common lathe tools, need no drawing, being tempered enough when merely hardened.

MALLEABLE CAST IRON.—The great secret of this sort of work is the annealing, which if not done properly the castings are of no use at all. The best mode is to take an iron pan, say one foot square: put in a layer of charcoal, then some of the castings, then another layer. When the pan is full cover it over with some sand, to keep the charcoal from burning away. Put on an old piece of iron for a lid to cover it all, put it in the annealing furnace, and get the heat up quite slow and gradually, taking care not to get the heat up too quick. After you have got it to the proper heat, which is this, the castings must be red hot through; keep it at this heat for 5 or 6 hours, then let your fire die gradually out, or, if you want to take some out and put more in, take them to a corner and bury them, pan and all,—let them lie there till properly cooled. Regarding the melting, procure not less than two good sorts of No. 2 pig iron, which you may mix with some good scrap if you choose; the casting, melting, and moulding are conducted in the same manner as common cast-iron, only the metal being hard, when casting, you have to make properly constructed runners and risers, or flow gates, if the article is likely to sink, for you cannot pump it well.

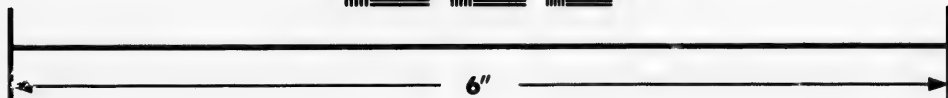
JAPANNING CASTINGS.—Clean them well from the sand, then dip them in or paint them over with good boiled linseed oil; when moderately dry, heat them in an oven to such a temperature as will turn the oil black, without burning. The stove should not be too hot at first, and the heat should be gradually raised to avoid blistering; the slower the change in the oil is effected the better will be the result. The castings, if smooth at first, will receive a fine black and polished surface by this method.

CONCERNING SAWS, RAILWAY SPRINGS, &C.—When the saws are wanted to be rather hard, but little of the oil tempering composition (See page 176) is burned off; when milder, a large portion; and for a spring temper the whole is allowed to burn away. Saws as well as springs appear to lose their elasticity, after hardening and tempering, from the reduction they undergo in grinding and polishing. Towards the conclusion of the manufacture, the elasticity of the saw is restored principally by hammering, and partly over a clear coke fire to a straw color; the tint is removed by very diluted muriatic acid, after which the saws are well washed in plain water and dried. Spring manufacture includes the heaviest specimens of hardened steel works uncombined with iron; for example, bow-springs for all kinds of vehicles, some intended for railway use, measure 3½ feet long, and weigh 50 lbs. each piece; two of these are used in combination; other single springs are 6 feet long, and weigh 70 lbs. The principle of these bow-springs will be immediately seen by conceiving the common archery bow fixed horizontally with its cord upwards; the body of the carriage being attached to the cord sways both perpendicularly and sideways with perfect freedom. In hardening them they are heated by being drawn backwards and forwards through an ordinary fire built hollow, and they are immersed in a trough of plain water. In tempering them they are heated until the black red is just visible at





A resolution test chart featuring several groups of horizontal and vertical lines of varying thicknesses. Each group is accompanied by a numerical value indicating its resolution. The values include 1.0, 1.1, 1.25, 1.4, 1.6, 1.8, 2.0, 2.2, 2.5, 2.8, 3.2, 3.6, 4.0, 4.5, 5.0, 5.6, 6.3, 7.1, 8.0, 9.0, 10, 11.2, 12.5, 14, 16, 18, 20, 22.5, 25, 28, 32, 36, 40, 45, 50, 56, 63, 71, 80, 90, 100, 112, 125, 140, 160, 180, 200, 225, 250, 280, 320, 360, 400, 450, 500, 560, 630, 710, 800, 900, 1000, 1120, 1250, 1400, 1600, 1800, 2000, 2250, 2500, 2800, 3200, 3600, 4000, 4500, 5000, 5600, 6300, 7100, 8000, 9000, 10000, 11200, 12500, 14000, 16000, 18000, 20000, 22500, 25000, 28000, 32000, 36000, 40000, 45000, 50000, 56000, 63000, 71000, 80000, 90000, 100000, 112000, 125000, 140000, 160000, 180000, 200000, 225000, 250000, 280000, 320000, 360000, 400000, 450000, 500000, 560000, 630000, 710000, 800000, 900000, 1000000, 1120000, 1250000, 1400000, 1600000, 1800000, 2000000, 2250000, 2500000, 2800000, 3200000, 3600000, 4000000, 4500000, 5000000, 5600000, 6300000, 7100000, 8000000, 9000000, 10000000, 11200000, 12500000, 14000000, 16000000, 18000000, 20000000, 22500000, 25000000, 28000000, 32000000, 36000000, 40000000, 45000000, 50000000, 56000000, 63000000, 71000000, 80000000, 90000000, 100000000, 112000000, 125000000, 140000000, 160000000, 180000000, 200000000, 225000000, 250000000, 280000000, 320000000, 360000000, 400000000, 450000000, 500000000, 560000000, 630000000, 710000000, 800000000, 900000000, 1000000000, 1120000000, 1250000000, 1400000000, 1600000000, 1800000000, 2000000000, 2250000000, 2500000000, 2800000000, 3200000000, 3600000000, 4000000000, 4500000000, 5000000000, 5600000000, 6300000000, 7100000000, 8000000000, 9000000000, 10000000000, 11200000000, 12500000000, 14000000000, 16000000000, 18000000000, 20000000000, 22500000000, 25000000000, 28000000000, 32000000000, 36000000000, 40000000000, 45000000000, 50000000000, 56000000000, 63000000000, 71000000000, 80000000000, 90000000000, 100000000000, 112000000000, 125000000000, 140000000000, 160000000000, 180000000000, 200000000000, 225000000000, 250000000000, 280000000000, 320000000000, 360000000000, 400000000000, 450000000000, 500000000000, 560000000000, 630000000000, 710000000000, 800000000000, 900000000000, 1000000000000, 1120000000000, 1250000000000, 1400000000000, 1600000000000, 1800000000000, 2000000000000, 2250000000000, 2500000000000, 2800000000000, 3200000000000, 3600000000000, 4000000000000, 4500000000000, 5000000000000, 5600000000000, 6300000000000, 7100000000000, 8000000000000, 9000000000000, 10000000000000, 11200000000000, 12500000000000, 14000000000000, 16000000000000, 18000000000000, 20000000000000, 22500000000000, 25000000000000, 28000000000000, 32000000000000, 36000000000000, 40000000000000, 45000000000000, 50000000000000, 56000000000000, 63000000000000, 71000000000000, 80000000000000, 90000000000000, 100000000000000, 112000000000000, 125000000000000, 140000000000000, 160000000000000, 180000000000000, 200000000000000, 225000000000000, 250000000000000, 280000000000000, 320000000000000, 360000000000000, 400000000000000, 450000000000000, 500000000000000, 560000000000000, 630000000000000, 710000000000000, 800000000000000, 900000000000000, 1000000000000000, 1120000000000000, 1250000000000000, 1400000000000000, 1600000000000000, 1800000000000000, 2000000000000000, 2250000000000000, 2500000000000000, 2800000000000000, 3200000000000000, 3600000000000000, 4000000000000000, 4500000000000000, 5000000000000000, 5600000000000000, 6300000000000000, 7100000000000000, 8000000000000000, 9000000000000000, 10000000000000000, 11200000000000000, 12500000000000000, 14000000000000000, 16000000000000000, 18000000000000000, 20000000000000000, 22500000000000000, 25000000000000000, 28000000000000000, 32000000000000000, 36000000000000000, 40000000000000000, 45000000000000000, 50000000000000000, 56000000000000000, 63000000000000000, 71000000000000000, 80000000000000000, 90000000000000000, 100000000000000000, 112000000000000000, 125000000000000000, 140000000000000000, 160000000000000000, 180000000000000000, 200000000000000000, 225000000000000000, 250000000000000000, 280000000000000000, 320000000000000000, 360000000000000000, 400000000000000000,



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night; by daylight the heat is denoted by its making a piece of wood sparkle when rubbed on the spring, which is then allowed to cool in the air. The metal is nine-sixteenths of an inch thick, and some consider five-eighths the limits to which steel will harden properly, that is sufficiently alike to serve as a spring. Their elasticity is tested far beyond their intended range.

ON RUBBER GOODS.—As many parties require to use rubber goods who are entirely ignorant of the cheap mixtures which are vended in large quantities, at enormous profits by manufacturers, I have thought proper in this place to irradiate the subject with a little "light" for the benefit of those whom "it may concern," and accordingly present the formulæ for compounding the different mixtures which enter into the composition of many articles sold quite extensively as *pure rubber* goods, but which, owing to large adulterations, in many cases cost 75 per cent. less than the prices charged for them. The first I shall present is for :

LIGHT BUFFER SPRINGS.—Grind together clear Java rubber, 25 lbs.; Para rubber, 5 lbs.; common magnesia, 10 lbs.; pure sulphur 25 ozs.; This is brown at first, but in a few days turns grey or white, and just sinks in water. Springs made from this compound, $4\frac{1}{2} \times 2\frac{1}{2} \times 1$, pressed to half an inch, showed $3\frac{1}{2}$ tons on the dial.

GREY PACKING FOR MARINE ENGINES &C.—Grind together cleaned Java rubber, 5 lbs.; Para rubber, 25 lbs.; oxide of zinc, 16 lbs.; carbonate of magnesia, 6 lbs.; Porcelain or Cornwall clay, 3 lbs.; red lead, 2 lbs.; pure sulphur, 30 ozs. It may be proper to state that good purified Java rubber might be substituted by engineers with good effect for Para rubber in the above and some other compositions.

RAG PACKING FOR VALVES, BEARING SPRINGS &C.—This is made principally from the useless cuttings in the manufacture of India rubber coats, when the gum is run or spread on calico foundations. Proportions as follows: grind together useless scraps, 35 lbs.; blacklead 18 lbs.; Java gum, 16 lbs.; yellow sulphur, 1 lb.

COMPOSITION FOR SUCTION HOSE FOR FIRE ENGINES, &C.—Grind together Java rubber, 20 lbs.; Para do, 10 lbs.; white lead, 14 lbs.; red lead, 14 lbs.; yellow sulphur, $1\frac{1}{2}$ lbs. This is spread upon flax cloth which weighs 10, 16, and 32 ozs. to the square yard.

COMMON BLACK PACKING.—Grind together, Java rubber, 15 lbs.; Para do., 15 lbs.; oxide of zinc, 15 lbs.; China or Cornwall clay, 15 lbs.; yellow sulphur, 28 ozs.

COMMON WHITE BUFFER RINGS, &C.—Grind together Java rubber, 30 lbs.; oxide of zinc, 18 lbs.; carbonate of magnesia, 6 lbs.; clean chalk or whiting, 6 lbs.; flour of sulphur, 2 lbs.

VULCANITE, OR EBONITE.—If the amount of sulphur added to the prepared rubber amounts to 10 per cent. and the operation of vulcanizing is performed in close vessels, at a temperature exceeding 300, or the heat required for VULCANIZING INDIA RUBBER as described under that head, which see, an article will be produced known as *vulcanite*, or *ebonite*. It is a black, hard, elastic substance, resembling horn in its texture and appearance, and capable of taking a very high polish. It is of great use in the arts, and is largely manufactured for making combs, door handles and hundreds

of articles hitherto made in ivory or bone. Its electrical properties also are very great.

BEST PURE SPRING, OR WASHERS.—Grind together Para gum, 30 lbs.; oxide of zinc, 5 lbs.; carb. magnesia, 2 lbs.; common chalk, 3 lbs.; Porcelain or Cornwall clay, 2 lbs.; pure sulphur, 30 oz.

COMPANION QUALITY TO ABOVE.—Para rubber, 30 lbs.; oxide of zinc, 5 lbs.; Porcelain or Cornwall clay, 5 lbs.; pure sulphur, 32 oz.

"HYPO" CLOTH FOR WATERPROOF COATS.—Grind together clean Java gum, 30 lbs.; lamp black, 5 lbs.; dry chalk or whiting, 11 lbs.; sulphuret of lead, 5 lbs. This composition is applied to waterproof garments.

TEMPERING LOCOMOTIVE TIRES.—This is quite ponderous work, as the tires of the eight foot wheels weigh about 10 cwt. and consist of about one-third steel. The materials for the tires are first swaged separately, and then welded together under the heavy hammer at the steel works, after which they are bent to the circle, welded, and turned to certain gauges. The tire is now heated to redness in a circular furnace; during the time it is getting hot, the iron wheel, previously turned to the right diameter, is bolted down upon a face-plate, the tire expands with the heat, and when at a cherry red, it is dropped over the wheel, for which it was previously too small, and is also hastily bolted down to the surface plate. The whole load is quickly immersed by a swing crane into a tank of water about five feet deep, and hauled up and down until nearly cold. The steel tires are not afterwards tempered. The spokes are forged out of flat-bars with T formed heads, these are arranged radially in the founder's mould whilst the cast-iron centre is poured around them, the ends of the T heads are then welded together to constitute the periphery of the wheel or inner tire, and little wedge-form pieces are inserted where there is any deficiency of iron. The wheel is then chucked on a lathe, bored and turned on the edge, not cylindrically, but like the meeting of two cones, and about one quarter of an inch higher in the middle than the two edges. The compound tire is turned to the corresponding form, and consequently, larger within or under cut, so that the shrinking secures the tire without the possibility of obliquity or derangement, and no rivets are required. It sometimes happens that the tire breaks in shrinking when by mismanagement the diameter of the wheel is in excess.

MANUFACTURING AND REPAIRING ANVILS.—The common anvil is usually made of seven pieces: 1, the core, or body; 2, 3, 4, 5, the four corner pieces, which serve to enlarge its base; 6, the projecting end, which has a square hole for the reception of the tail or shank of a chisel on which iron bars may be cut through, and 7, the beak, or horizontal cone, round which rods or slips of metal may be turned in a circular form, as in making rings. These six pieces are welded separately to the first or core, and then hammered into a uniform body. In manufacturing large anvils two hearths are needed, in order to bring each of the two pieces to be welded to a proper heat by itself, and several men are employed in working them together briskly in the welding state, by heavy swing hammers. The steel facing is applied by welding in the

same manner, powdered borax with sal ammoniac (1 part to 10 parts of borax) being used as a flux. The anvil is then heated to a cherry red, and plunged into cold water, a running stream being better than a pool or cistern, the rapid formation of steam at the sides of the metal preventing the free access of the water for the removal of the heat with the required expedition. In some cases a stream of water is contrived to descend from a cistern above on the part to be chilled, which is sure to render it very hard. The facing should not be too thick a plate, for when such, it is apt to crack in the hardening. It is somewhat dangerous to stand near such works at the time, as when the anvil face is not perfectly welded, it sometimes, in part, flies off with great violence and a loud report. In the case of broken anvils the repairs will have to be made in accordance with the above description. In finishing off the face, it is smoothed upon a grindstone, and, for fine work, polished with emery and crocus.

HARDENING AXLETREES AND BOXES.—The method now used in the manufacture of Murphy's axletrees is to use wrought iron and weld two pieces of steel into the lower side, where they rest upon the wheels and sustain the load. The work is heated in an open forge fire, in the ordinary way, and when it is removed, a mixture, principally prussiate of potash is laid upon the steel; the axletree is then immediately immersed in water, and additional water is allowed to fall upon it from a cistern. The steel is considered to be very materially hardened by the treatment, and the iron around the same is also partially hardened. One very good way to chill axletree boxes is to mould from wooden patterns on sand, and cast them upon an iron core which has the effect of making them very hard. To form the annular recess for oil, a ring of sand, made in an appropriate core-box, is slipped upon the iron mandril, and is left behind when the latter is driven out of the casting.

TO PURIFY ZINC.—Pure zinc may be obtained by precipitating its sulphate by an alkali, mixing the oxide thus produced with charcoal powder, and exposing the mixture to a bright red heat in a covered crucible in which the pure metal will be found as a button at the bottom when cold.

TO GALVANIZE CAST-IRON THROUGH AND THROUGH.—To 50 lbs. melted iron add 1 lb. pulverized zinc, chemically pure. Directions, scatter the zinc powder well over the ladle, then catch the iron and pour at once. It is better, just before pouring, to stir the iron well, in order that a more complete union of the metals may take place.

TO CHILL CAST IRON VERY HARD.—Use a liquid made as follows: soft water, 10 gallons; salt, 1 peck; oil vitriol, $\frac{1}{2}$ pt; saltpetre, $\frac{1}{2}$ lb.; prussiate of potash, $\frac{1}{2}$ lb.; cyanide of potash, $\frac{1}{2}$ lb. Heat the iron a cherry red and dip as usual, and if wanted harder repeat the process.

ANOTHER TO HARDEN CAST IRON.—Salt, 2 lbs.; saltpetre, $\frac{1}{2}$ lb.; roche alum, $\frac{1}{2}$ lb.; ammonia, 4 ozs. salts of tartar, 4 ozs.; pulverize all together and incorporate thoroughly, use by powdering all over the iron while it is hot, then plunging it in cold water.

TO MAKE BORAX.—Alum, 2 ozs.; dilute with water; and mix with 2 ozs. potash, boil in a pot half an hour over a gentle fire, take it

out of the water, add 2 ozs. gem salt in powder, as much of alkaline salt, 1 lbs. honey, and 1 of cow's milk, mix all together, set it in the sun for 3 days and the borax is ready for use. This will go twice as far in a blacksmith's shop as common borax.

WELDING CAST STEEL.—Silver sand 2 lbs. plaster of Paris, 1 lb.; mix thoroughly. Heat your article and dust it with the above, place it in the fire again until you get a red heat and it will weld.

RESPIRATOR.—An excellent respirator may be made of a thick sheet of carded cotton wool placed between two pieces of muslin. Unequalled for arresting dust, steel particles &c.

ANNEALING STEEL.—For small pieces of steel, take a piece of gas pipe 2 or 3 inches in diameter, and put the pieces in it, first heating one end of the pipe, and drawing it together, leaving the other end open to look into. When the pieces are of a cherry red, cover the fire with saw dust, use a charcoal fire, and leave the steel in over night.

TO DRILL HARDENED STEEL.—Cover your steel with melted beeswax; when coated and cold make a hole in the wax with a fine pointed needle or other article the size of hole you require, put a drop of strong nitric acid upon it, after an hour rinse off, and apply again, it will gradually eat through.

TO PREVENT IRON RUSTING.—Give it a coat of linseed oil and whiting, mixed together in the form of a paste. It is easily removed and will preserve iron from rusting for years.

TO CAST BRASS SOLID.—The metal should not be run any hotter than is necessary to insure sharp castings. The most probable cause of the honey combings of castings is that the air cannot get out of the way; and there ought to be proper vents made for it from the highest parts of the mould; the metal should be run in near or at the bottom of the mould. If about 1 lb. of lead be added to every 16 lbs. of old brass, when just at the melting point, solid good brasses will be the result. In melting old brass the inc. of lead contained in it (when fluid) oxidizes freely; consequently the proportions of the metal are altered, and require an addition similar to the above. If the brass has not been re-cast a little loss lead will do, but if re-cast several times it may take the full quantity.

TO RECOVER THE TIN FROM OLD BRITANNIA.—Melt the metal, and while hot sprinkle sulphur over it; and stir it up for a short time, this burns the other metals out of the tin, which may then be used for any purpose desired.

GLUE FOR LABELLING ON METALS.—Boiling water, 1 qt.; pulverized borax, 2 ozs.; gum shellac, 4 ozs. Boil till dissolved. Used for attaching labels to metals, or it will do to write inscriptions with, and dust or dab on a little bronze powder over it, varnishing over the bronze.

RUSSIA SHEET IRON.—Russia sheet iron is, in the first instance, a very pure article, rendered exceedingly tough and flexible by refining and annealing. Its bright, glossy surface is partially a silicate, and partially an oxide of iron, and is produced by passing the hot sheet, moistened with a solution of wood-ashes, through polished steel rollers.

COMPOSITE IRON RAILINGS.—The process by which this light, elegant and cheap fabric is manufactured, is as follows:—Rods

and bars of wrought-iron are cut to the lengths desired for the pattern, and subjected to a process called crimping, by which they are bent to the desired shape. These rods are then laid in the form of the design, and cast-iron moulds are affixed at those points where a connection is desired; the moulds are then filled with melted metal, and immediately you have a complete railing of beautiful design. Casting in iron moulds has this great advantage over the old sand moulding, it does not require any time for cooling, as the metal is no sooner run than the moulds may be removed and used again immediately on another section of the work; and, besides, it is so much more easily effected. By the combination of wrought and cast-iron in this process, the most curious and complex designs may be produced with great rapidity and cheapness.

VON BIBRA'S ALLOY FOR MEDALS.—Bismuth, 27.27 parts; lead, 59.09 parts; tin, 13.64 parts. If the cast objects be bitten with dilute nitric acid, washed with water, and rubbed with a woollen rag, the elevated spots become bright while the sunken portions are dull, and the casting acquires a dark gray appearance, with an antique lustre. Without biting, the color is light-gray.

NEW SHEATHING METAL.—This alloy is made by melting $2\frac{1}{2}$ parts of copper in one crucible, in another 9 parts of zinc, 87 of lead, 1 part of mercury, and $\frac{1}{2}$ part of bismuth, then mixing the contents of both crucibles, covering the surface with charcoal dust, and stirring well till all are incorporated. It is stated that the mercury in this alloy protects both the zinc and copper from the action of sea-water. The contents of the crucible are run into ingots, and rolled into sheets.

IRON TUBE MANUFACTURE.—In the present method of manufacturing the patent welded tube, the end of the skelp is bent to the circular form, its entire length is raised to the welding heat in an appropriate furnace, and, as it leaves the furnace almost at the point of the fusion, it is dragged by the chain of a draw-bench, after the manner of wire, through a pair of tongs with two bell-shaped jaws; these are opened at the time of introducing the end of a skelp, which is welded without the agency of a mandril. By this ingenious arrangement wrought iron tubes may be made from the diameter of 6 inches internally and about 1-8 to 3-8 of an inch thick, to as small as 1-4 of an inch diameter and 1-10 bore, and so admirably is the joining effected in those of the best description that they will withstand the greatest pressure of water, steam or gas to which they have been subjected, and they admit of being bent both in the heated and cold state, almost with impunity. Sometimes the tubes are made one upon the other when great thickness is required; but those stout pipes, and those larger than 3 inches, are but seldom required. The wrought iron tubes of hydrostatic presses, which measure about $\frac{1}{2}$ an inch internally, and $\frac{1}{4}$ to 3-8 of an inch thick in the metal, are frequently subjected to a pressure of *four tons* on each square inch.

BRASS TUBES.—Brass or other tubes are formed of rolled metal which is cut to the desired width by means of revolving discs; in the large sizes of tubes, the metal is partially curved in its length by means of a pair of rolls, when in this condition it is passed

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through a steel hole or a die, a plug being held in such a position as allows the metal to pass between it and the interior of the hole. Oil is used to lubricate the metal, the motion is communicated by power, the drawing apparatus being a pair of huge nippers, which holds the brass, and is attached to a chain and revolves round a windlass or cylinder. The tube in its unsoldered state is annealed, bound round at intervals of a few inches with iron wire, and solder and borax applied along the seam. The operation of soldering is completed by passing the tube through an air stove, heated with "cokes" or "breezes" which melts the solder, and unites the two eyes of the metal, and forms a perfect tube ; it is then immersed in a solution of sulphuric acid, to remove scaly deposits on its surface, the wire and extra solder having been previously removed ; it is then drawn through a "finishing hole plate" when the tube is completed.

Mandril drawn tubes are drawn upon a very accurately turned steel mandril, by this means the internal diameter is rendered smooth. The tubes drawn by this process are well adapted for telescopes, syringes, small pump cylinders, &c. The brass tubes for the boilers of locomotive engines are now made by casting and drawing without being soldered, and some of them are drawn taper in their thickness. Tubes from 1-10 inch internal diameter and 3 or ten inches long, up to those of two or three inches diameter and 4 or 5 feet long, are drawn vertically by means of a strong chain wound on a barrel by wheels and pinions, as in crane. In Donkin's tube drawing machine, which is applicable to making tubes, or rather cylinders, for paper-making and other machinery, as large as 26½ inches diameter, and 6½ feet long, a vertical screw is used, the nut of which is turned round by toothed wheels driven by six men at a windlass.

The fluted tubes of pencil cases are drawn through ornamental plates, with elevations and depressions corresponding to the impressions left on the tube.

DAMASCUS TWIST AND STUB-TWIST GUN-BARRELS.—The twisted barrels are made out of long ribbands of iron, wound spirally around a mandril, and welded on their edges by jumping them on the ground, or rather on an anvil embedded therein. The plain stub barrels are made in this manner, from iron manufactured from a bundle of stub-nails, welded together, and drawn out into ribbands, to insure the possession of a material most thoroughly and intimately worked. The Damascus barrels are made from a mixture of stub-nails and clippings of steel in given proportions, puddled together, made into a bloom, and subsequently passed through all the stages of the manufacture of iron, in order to obtain an iron that shall be of an unequal quality and hardness, and therefore display different colors and markings when oxidized or browned. Other twisted barrels are made in the like manner, except that the bars to form the ribbands are twisted whilst red hot, like ropes, some to the right, others to the left, and which are sometimes laminated together for greater diversity. They are subsequently again drawn into the ribbands and wound upon the mandril, and frequently two or three differently prepared pieces are placed side by side to form the complex and ornamental figures for the barrels of

fowling-pieces, described as *stub-twist*, *wire-twist*, *Damascus-twist*, &c. Sometimes Damascus gun-barrels are formed by arranging twenty-five thin bars of iron and mild steel in alternate layers, welding the whole together, drawing it down small, twisting it like a rope, and again welding three such ropes, for the formation of the ribband, which is then spirally twisted to form a barrel, that exhibits, when finished and acted upon by acids, a diversified, laminated appearance, resembling, when properly managed, an ostrich feather.

MANUFACTURING CHAINS.—For this purpose the iron is cut off with a plain chamfer, as from the annular form of the links their extremities cannot slide asunder when struck. Every succeeding link is bent, introduced, and finally welded. In some of these welded chains the links are no more than $\frac{1}{2}$ an inch long, and the iron wire $\frac{1}{8}$ inch diameter. These are made with great dexterity by a man and a boy, at a small fire. The curbed chains are welded in the ordinary way and twisted afterwards, a few links being made red-hot at a time for the purpose. The massive cable chains are made much in the same manner, although partly by aid of machinery. The bar of iron, now one, one and a half, or even two inches in diameter, is heated, and the scarf is made as a plain chamfer, by a cutting machine; the link is then formed by inserting the edge of the heated bar within a loop in the edge of an oval disk, which may be compared to a chuck fixed on the end of a lathe mandril. The disk is put in gear by the steam engine; it makes exactly one revolution and throws itself out of motion. This bends the heated extremity of the iron into an oval figure. Afterwards it is detached from the rod with a chamfered cut by the cutting machine, which, at one stroke, makes the second scarf of the detached link, and the first of that next to be curled up. The link is now threaded to the extremity of the chain, closed together and transferred to the fire, the loose end being carried by a traverse crane. When the link is at the proper heat, it is returned to the anvil, welded, and dressed off between top and bottom tools, after which the cast iron transverse stay is inserted, and the link having been closed upon the stay, the routine is recommenced. The work commonly requires three men, and the scarf is placed at the side of the oval link, and flat way through the same. In similar chains made by hand it is, perhaps, more customary to weld the link at the *crown*, or small end.

BUTTON MANUFACTURE.—Metal buttons are formed of an inferior kind of brass, pewter, or other metallic compositions. For button metal, see a variety of alloys on pages 191 and 193. Buttons with shanks are usually made of these compositions, which is supplied to the manufacturers in sheets of the required thickness. By means of fly presses and punches, circular disks called *blanks*, are cut out of these sheets. This is mostly performed by females, who can furnish about 30 blanks per minute, or 12 gross per hour. Hand punching is the general mode of cutting out blanks, but more complicated machines, which cut out 8 or 10 blanks at a time, are in use. After being punched, the edges of the blanks are very sharp, and require to be smoothed and rounded. Their surfaces are then planished on the face by placing them separately in a die

under a small stand, and allowing them to receive a smart blow from a polished steel hammer. In this state they are ready to receive the shanks or small metal loops by which they are attached to the dress. They are made by a machine in which a coil of wire is gradually advanced towards a pair of shears which cuts off short pieces. A metal finger then presses against the middle of each piece, first bending it and then pressing it into a vice, when it is compressed so as to form a loop; a hammer then strikes the two ends, spreading them into a flat surface, and the shank is pushed out of the machine ready for use. The shanks are attached to the blanks by women, with iron wire, solder and rosin. They are then put into an oven, and, when firmly united, form plain buttons. If a crest or inscription is wanted, it is placed in a die and stamped. Buttons are gilded by gold amalgam, by being put into an earthen pan with the proper quantity of gold to cover them, amalgamated with mercury in the following manner: the gold is put into an iron ladle in thin strips, and a small quantity of mercury, say 1 part of mercury to 8 of gold, added to it, the ladle is held over the fire till the gold and mercury are perfectly united. This amalgam being put into the pan with the buttons, as much aquafortis, diluted with water, as will wet them all over, is thrown in, and they are stirred up with a brush till the acid, by its affinity to the copper in the buttons, carries the amalgam to every part of their surface, giving it the appearance of silver; this done, the acid is washed away with clean water. This is called the *quicking* process. In *drying off*, the pan of buttons is heated by a charcoal fire expelling the mercury in the form of a vapor, which, under the improved system, is conducted into an oblong iron flue or gallery, gently sloped downwards, having at its end a small vertical tube dipped into a water cistern, for condensing the mercury, and a large vertical pipe for promoting the draught of the products of the combustion. The gold thus deposited in an exceedingly thin film upon the buttons, presents a dull yellow color, and must now be burnished; this is effected by a piece of hematite, or bloodstone, fixed on a handle and applied to the button, as it revolves in the lathe.

CUTLERY MANUFACTURE.—There are three kinds of steel employed in manufacture of different articles of cutlery, common steel, shear steel, and cast steel. All edge tools which require to be tenacious without being very hard, are made of shear steel. The best scissors, razors, penknives, &c., are made from cast steel, which is able to take a very fine polish. Common steel is only used in making cheap articles of cutlery. In making good table-knives, shear steel and cast steel are generally preferred. In the ordinary method of making knives, the blades are cut out of a sheet of steel, and the backs, shoulders and tangs of wrought iron, are attached to the steel blades by welding at the forge. The knife is then ground to the proper shape, and the blade polished and hardened. The fork manufacture is a distinct branch of industry, and the manufacturers of table knives generally buy their forks from the fork makers ready to be put into their hands. In making table knives, two men are generally employed; one is called the *foreman*, or *maker*, and the other the *striker*. Penknives are usually forged by a single

hand, with hammer and anvil simply ; they are hardened by heating the blades red-hot, and dipping them into water up to the shoulder. Razors are also hardened in the same manner. The grinding and polishing of cutlery are generally performed by machinery, the business of the grinders is divided into grinding, glazing and polishing. Grinding is performed upon stones of various dimensions. Those articles which require temper being ground on wet stones. Glazing is a process by which lustre is given to cutlery ; it is performed with a glazier, consisting of a circular piece of wood, sometimes covered with leather, or an alloy of lead and tin ; it is fixed on an axis like a grindstone. The polishing process is the last, and is performed on a similar piece of wood covered with buff leather. Only articles of cast steel which have been hardened and tempered are subjected to this operation.

DAMASKEENING.—This is the art, now in a great measure lost, of producing a watered or wavy appearance on steel sword-blades, armour, &c., or of inlaying and encrusting steel with gold and silver, originally practised at Damascus. Various methods of damaskeening were practised, but the most common seem to have been those of welding two different kinds of steel, or steel and iron, together, or of cutting lines on the surface of the steel and filling them with gold or silver, which was either forced into the incised lines and brought to a level with the surface of the steel, or remained in relief above it. When the former method was used, a light pattern, generally in many lines, was produced on a dark ground, or *vice versa*, and the junction of the metals caused the pattern to run through the entire thickness of the blade, so that it could not be obliterated even by grinding.

DIE SINKING. When a die is required for a coin or medals, the engraver takes a piece of soft steel of suitable dimensions, generally 3 or 4 inches in length, and about an inch greater in diameter than the coin or other article required, on this he hollows out the exact form of the desired impression by cutting away the steel by degrees, with small, well-tempered, case-hardened tools. As soon as this work is thoroughly accomplished the steel is hardened by being heated red-hot in a crucible with charcoal and oil or bone-dust, and then plunged into cold water. When a great number of coins of one sort are required, the original die is termed the matrix, and copies are made from it by taking impressions from it in soft steel, which is in relief, and is called the puncheon, and from which, when it has been hardened, other dies are produced by pressure exactly similar to the matrix, and in *intaglio*, which are case-hardened in their turn before they are fit to transmit an impression to any metal used for money. The metal used for our coinage, whether gold, silver, copper, or bronze is stamped in a cold and solid state ; but medals and casts can also be produced by a method called casting *en cliché*, in which the metal is used in a soft state. For this purpose an alloy is used, consisting of $\frac{1}{4}$ lead, $\frac{1}{4}$ tin, and $\frac{1}{2}$ bismuth, which fuses readily at the boiling point, 212° Fah. When the metal is soft, resembling paste in consistency, the die is placed upon it, and the impression produced by a smart blow from a mallet ; the surface of the metal sets instantly, from coming into contact with the cold die, and thus readily retains the form that

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has been given to it. Copies of medals may be readily made in this way, but each face will be obtained in a separate piece, and these must be joined to give representations of the coin in a complete form. Ornamental work is produced in thin metal for gasfitting, cornices, parts of cruet-stands, trays, &c., by means of a pair of dies, on one of which the pattern is formed in relief, and on the other in *intaglio*, the metal being placed between them, and brought into the desired shape by pressure. Dies are also made in metal for forming articles in gutta-percha and leather, and producing embossed figures on the cloth covers of books, as well as on card-board, paper, &c.

STEELPLATE ENGRAVING. As regards steelplate engraving it has proved immensely superior to the old copperplate system. A soft steelplate is first engraved with the required subject in the most finished style of art, either by hand or mechanically, or the two combined, and the plate is then hardened; a softened steel cylinder is then rolled over the hardened plate, with great pressure by powerful machinery, until the engraved impression appears in relief,—the hollow lines of the original becoming ridges upon the cylinder, the roller is re-converted to the condition of ordinary steel, and hardened, after which it serves for returning the impression to any number of decarbonized plates, every one of which becomes absolutely a *counterpart* of the original, and every plate, when hardened, would yield the enormous number of 150,000 impressions, without any perceptible difference between the first and the last. In one instance, from one engraving of the Queen's head on the postage stamp, over 6000 plates were produced from the original, and plates for bank-note printing are multiplied in the same way. Great caution must be used in the various processes of annealing and hardening, as only slight carelessness would result in ruining the most costly plates. The method in use in the bank of England is as follows: the work to be hardened is enclosed in a wrought-iron box with a loose cover, a false bottom, and with three ears projecting from its surface about midway; the steel is surrounded on all sides with carbon from leather, driven in hard, and the cover and bottom are carefully luted with moist clay, thus prepared, the case is placed in the vertical position, in a bridge fixed across a great tub, which is then filled with water almost to touch the flat bottom of the case; the latter is now heated in the furnace as quickly as will allow the uniform penetration of the heat. When sufficiently hot, it is removed to its place in the hardening tub, the cover of the iron box is removed, and the neck or gudgeon of the cylinder is grasped, *beneath the surface of the carbon*, with a long pair of tongs, upon which a couplet is dropped to secure the grasp. It only remains for the individual to hold the tongs with a glove whilst a smart tap of the hammer is given to their extremity; this knocks out the false bottom of the case and the cylinder, and the tongs prevent the cylinder from falling on its side, and thus injuring its delicate but still hot surface. For square plates; a suitable frame is attached by four slight claws, and it is the frame which is seized by the tongs; the latter are sometimes held by a chain which removes the risk of accident to the individual. The steel comes out of the water as

smooth to the touch as at first, and mottled with all the beautiful tints of case-hardened gun-locks.

ON FILE MANUFACTURE.—Files are made of bars of steel, rendered doubly hard by a process called *double conversion*, drawn the required size at the tilt hammer, and then shaped, the square and flat ones by the hammer and common anvil only, but those of round, half-round, and three-angled forms, by means of bosses and dies made in the above shapes, which fit into a groove left for them in the anvil. The steel blanks having been thus formed, are next *annealed*, or softened, to render them capable of being cut, by placing a number of them together in a brick oven, rendered airtight by filling up all the interstices with sand (to prevent the oxidation of the steel, to which it is very liable, if air be admitted), and then making a fire play as equally as possible all round until they are red hot, when the heat is discontinued, and the steel allowed to cool gradually before it is uncovered. The surface to contain the teeth is now rendered as smooth as possible by grinding or filing; the teeth are then cut with a carefully ground chisel, each incision being made separately. The next and last process, that of *hardening*, is performed in various ways by different makers, the ordinary method, however, is to cover the files with a kind of composition or protecting varnish to prevent oxidation and scalding of the steel when heated; and, lastly, they are plunged in cold, fresh water to cool them as quickly as possible. Some file-makers coat their files, before tempering, with a composition of cow-dung or pig-flour, which not only protects the sharp angles of the cuttings from the action of the fire, but furnish a highly azotized substance, which conduces greatly to still further harden and steelify the finished work. I know several file manufacturers who make use of a bath of melted lead for tempering purposes. The files are first coated with a greasy composition to prevent any oxide adhering, then introduced for a short time into melted lead, or the "metallic bath" as it is called, and then plunged in to the tempering liquid. The melted lead may be kept covered with charcoal, or other suitable ingredient, to prevent oxidation. In some manufactories a charcoal fire is kept burning on the surface of the melted lead.

PEN MAKING.—Pens should be made of the best steel that can be got, as peculiar elasticity is required in them, which could not be obtained if poor steel were used. The steel is cut into slips some 3 feet long and 4 inches broad; these slips are then plunged into a pickle of diluted sulphuric acid so as to remove the scales from the surface; next it is passed between heavy rollers by which it is reduced to the thickness required, and made fit to undergo the first process in pen making. This is performed by a girl, who, seated at a stamping-press provided with a bed and corresponding punch, speedily cuts out the blank, which is perfectly flat. The next step is to perforate the hole which terminates the slit, and to remove any superfluous steel which might interfere with the elasticity of the pen. The embryo pens are then annealed in a muffle, and the maker's name stamped upon them. The pens are next transferred to another class of workmen, who, by means of a press, either make the pens concave, if they are merely to be nibs, or, if they are to be barrel pens, they roll the barrel together. The next process is

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termed the *hardening*, and consists in placing a number of pens in an iron box which is introduced into a muffle. After they become of a deep red heat they are plunged into a tank of oil, and, when they get cool, the adhering oil is removed by agitation in circular tin barrels; *tempering* is the next step, by heating to the necessary elasticity in a warm bath of oil; and, finally, the whole number of pens are placed in a revolving cylinder along with sand, ground crucible, and other cutting substances, which tends to brighten them up to the natural color of the steel; next the nib is ground down finely, with great rapidity, by a girl, who picks it up with a pair of pliers, and, with a single touch on an emery revolving wheel, perfects it at once. The slit is now made by means of a press. A chisel, or wedge, with a flat side, is affixed to the bed of the press, and the descending screw has a corresponding chisel-cutter, which passing down with the greatest accuracy on the pen, which had been placed on the chisel affixed to the bed, and the slit is made and the pen complete. They are next colored brown or blue, by placing them in a revolving metal cylinder, under which is a charcoal stove, and, by watching narrowly the different gradation of color, the requisite tint is speedily attained; a brilliant polish is subsequently imparted by immersing the pens in lac dissolved in naphtha; they are then dried, counted, selected and placed in boxes for sale.

GOLD PENS.—Gold pens are made much in the same manner as steel, with this important difference, that, as they cannot be tempered in the same way that steel is, the necessary elasticity is imparted to them by hammering, and by rubbing them with a small hard stone and water, instead of the tempering, &c., in oil. As gold is too soft of itself to make a durable pen, it is found necessary to attach a minute portion of an alloy of iridium and osmium, by soldering to the tips. This makes an extremely hard and durable point.

ON NEEDLE MANUFACTURE, TEMPERING, &C.—This small but important implement has to go through the hands of about 120 workmen during the process of manufacture. The steel wire, being drawn to the proper size, is submitted to various tests to ascertain its quality, and is then cut into proper lengths by shears, which, by striking 21 blows in a minute, cut in 10 hours fully 400,000 ends of steel wire, which produce about 800,000 needles. These are passed on for further manipulation to other workmen, who straighten and point the pieces of wire. After pointing they are cut in two, so as to form two separate needles of equal length and quality. For each different size a small copper plate is employed. It is nearly square, and has a turned-up edge on two of its sides, the one is intended to receive all the points, while the other resists the pressure of the shears. On this plate a certain number of wire are put with their points in contact with the border, and they are cut together flush with the plate, by means of a small pair of shears moved by the knee of the workman. These even wires are now taken to the *head flattener*. This workman, seated over a table with a block of steel before him about 3 inches cube, takes up from 20 to 25 needles between his finger and thumb, spreading them out like a fan, with the points under the thumb, he lays the heads on the steel block, and, with a small flat-faced hammer strikes a few successive blows upon them

so as to flatten them in an instant. The heads, having become hardened by hammering, are now annealed by heating and slow cooling, and are handed to the *piercer*, generally a child, who forms the eye in a second by laying the head upon a block of steel, and by driving a small punch through one side with a smart tap of the hammer, and then exactly opposite on the other. The eyes are then trimmed by driving the punch through them again on a lump of lead and, after laying the needle with the punch sticking through it, upon the block of steel, hammering the head on the sides, which causes it to take the form of the punch. The next operator makes the groove at the eye and rounds the head, which he does with a small file. The needles, being thus prepared, are thrown by the workmen pell-mell into a sort of drum or box, in which they are made to arrange themselves in parallel lines by means of a few dexterous shakes of the workman's arm. They are now ready to be tempered, for which purpose they are ranged on sheet-iron plates, about 30 lbs. weight at a time, containing from 250,000 to 500,000 needles, and are placed in a proper furnace, when they are heated to a bright redness for the larger needles, and to a less intense degree for the smaller; they are then removed, and inverted suddenly over a bath of cold water in such a way that all the needles may be immersed at the same time, yet separate from each other. This has the effect of making them very hard and brittle. The water being run off, the needles are removed for further operations. Some manufacturers heat the needles by means of immersion in melted lead, others throw them into a pan along with a quantity of grease, which, being placed on the fire, the oily matter soon ignites, and after it burns out, the needles are found to be in the proper temper; those which are twisted in the tempering being afterwards straightened by the hammer on the anvil.

Polishing is the next and most expensive and prolonged operation. This is effected on bundles containing 500,000 needles intermixed with quartzose sand, and a little rape-seed oil. Thirty of those bundles are exposed to the vibratory pressure of wooden tables, which make about 20 horizontal double movements per minute, causing the bundles to run over 2 feet each time, or 800 feet per hour. This agitation is kept up about 18 or 20 hours, causing such a movement and attrition as to polish the needles in the bags or bundles. They are then removed from the packets into wooden bowls and mixed with sawdust to remove the grease and other impurities, placed in a cask, which is turned by a winch; more sawdust is introduced as required, and the turning is continued until the needles become clean and bright. They are then winnowed by a fan to clean them from the sawdust and refuse matter, and are subsequently arranged in regular order on a small, somewhat concave, iron tray. The operation of making up the rolls or bags, polishing, winnowing and arranging them, have to be repeated ten times on the best needles. It is found that emery powder mixed with quartz and mica or pounded granite is preferable to anything else for polishing needles by friction in the bags at the first, emery mixed with olive oil, from the second to the seventh operation, putty, or oxide of tin for the eight and ninth, putty with very little

oil for the tenth, and lastly bran to give a finish. In this mode of operating, the needles are scoured in a copper cask studded in the interior with raised points to increase the friction and a quantity of hot soap suds is introduced occasionally to keep them clean. The cask must be slowly turned upon its axis for fear of injuring the mass of needles it contains. They are finally dried in the wooden cask by attrition with saw dust, then wiped with a linen rag or soft leather—the damaged ones being thrown aside. The *sorting* is performed in dry apartments, where all the points are first laid the same way, and the needles arranged in the order of their polish with great rapidity. The workman places 2000 or 3000 needles in an iron ring two inches in diameter, and sets all their heads in one plane, then, on looking carefully at their points, he easily recognizes the broken ones and removes them with a instrument adapted for the purpose. These defective needles pass into the hands of the *pointer* in order to be ground again, when they form articles of inferior value. Those needles bent in the polishing must now be straightened, and the whole are finally arranged by the tact of the finger and thumb of the sorter, and weighed out into quantities for packing into blue papers. The *bluer* puts the final touch to them by taking 25 needles at a time between his fore-finger and thumb, and pressing their points against a small hone-stone of compact micaceous schist, quadrangular in form, mounted in a small lathe, turning them briskly round, giving the points a bluish cast, while he polishes and improves them.

BALANCE SPRINGS OF CHRONOMETERS.—The balance springs of marine chronometers, which are in the form of a screw, are wound into the square thread of a screw of the appropriate diameter and coarseness; the two ends of the spring are retained by side screws, and the whole is carefully enveloped in platinum foil, and lightly bound with wire. The mass is next heated in a piece of gun barrel closed at one end, and plunged into oil, which hardens the spring almost without discolouring it, owing to the exclusion of the air by the close platinum covering, which is now removed, and the spring is let down to the blue before removal from the screwed block. The balance or hair spring of *common* watches are frequently left soft, those of the *best* watches are hardened in the coil upon a plain cylinder and are then curled into the spiral form between the edge of a blunt knife and the thumb, the same as in curling up a narrow ribbon or paper, or the filaments of an ostrich feather. The soft springs are worth 60 cents each, those hardened and tempered \$1.25 each. This raises the value of the steel, originally less than 4 cents, to \$2000 and \$3000 respectively. It takes 3200 balance springs to weigh an ounce.

WATCH SPRING MANUFACTURE.—Watch springs are hammered out of round steel wire, of suitable diameter until they fill the gauge, for width, which at the same time insures equality of thickness. The holes are punched in their extremities, and they are trimmed on the edge with a smooth file. The springs are then tied up with binding wire, in a loose *open* coil and heated over a charcoal fire upon a perforated revolving plate. They are hardened in oil and blued off. The spring is now distended in a long metal frame, similar to that used for a saw blade, and ground and polished with emery and

oil between lead blocks. By this time its elasticity appears quite lost, and it may be bent in any direction; its elasticity is, however, entirely restored by a subsequent hammering on a very bright anvil which puts the "*nature into the spring*." The coloring is done over a flat plate of iron, or hood, under which a small spirit lamp is kept burning; the spring is continually drawn backward and forward, about two or three inches at a time, until it assumes the orange or deep blue tint throughout, according to the taste of the purchaser. By many the coloring is considered to be a matter of ornament and not essential. The last process is to coil the spring into the spiral form, that it may enter the barrel in which it is to be contained. This is done by a tool with a small axis and winch handles, and does not require heat.

COMPENSATION BALANCE OF CHRONOMETERS.—The balance is a small piece of steel covered with a hoop of brass. The rim, consisting of the two metals, is divided at the two extremities the one diametrical arm of the balance, so that the increase of temperature which weakens the balance springs contract, in a proportionate degree, the diameter of the balance, leaving the spring less resistance to overcome. This occurs from the brass expanding much more by heat than steel, and it therefore curls the semicircular arc inwards, an action that will be immediately understood, if we conceive the compound bar of steel to be straight, as the heat would render the brass side longer and convex, and in the balance it renders it more curved. In the compensation balance the two metals are united as follows: the disk of steel when turned and pierced with a central hole is fixed by a little screw-bolt and nut at the bottom of a small crucible, with a central elevation smaller than the disk; the brass is now melted and the whole allowed to cool. The crucible is broken, the excess of brass is turned off in the lathe, the arms are made with the file as usual, the rim is tapped to receive the compensation screws or weights, and, lastly, the hoop is divided in two places at the opposite ends of its diametrical arm.

TABULAR VIEW OF THE PROCESSES OF SOLDERING.—*Hard soldering.* The hard solders most commonly used are the spelter solders, and silver solders. The general flux is borax, marked A, on the table, and the modes of heating are the naked fire, the furnace or muffle, and the blow pipe, marked a, b, g, applicable to nearly all metals less fusible than the solders; the modes of treatment are nearly similar throughout. *Note.*—The examples commence with the solders (the least fusible first) followed by the metals for which they are commonly employed. Fine gold, laminated and cut into shreds, is used as the solder for joining chemical vessels made of platinum. Silver is by many considered as much the best solder for German silver, for silver solders, see pages 153 and 154. Copper cut in shreds, is sometimes similarly used for iron. Gold solders laminated are used for gold alloys, see 153 and 154. Spelter solders, granulated whilst hot, are used for iron, copper, brass, gun metals, German silver, &c, see 189. Silver solders, laminated are employed for all silver works and for common gold work, also for German silver, gilding metal, iron, steel, brass, gun metal, &c, when greater neatness is required than is obtained from spelter solder.

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White or button solders, granulated, are employed for the white alloys called button metals; they were introduced as cheap substitutes for silver solder.

Hard Soldering. Applicable to nearly all the metals; the modes of treatment are very different. The soft solder mostly used is 2 parts tin and one of lead; sometimes, from motives of economy, much more lead is employed, and $1\frac{1}{2}$ tin to 1 lead is the most fusible of the group, unless bismuth is used. The fluxes B to G, and the modes of heating *a* to *i*, are all used with the soft solders.

Note.—The examples commence with the metals to be soldered. Thus in the list zinc, 8, *c, f*, implies, that zinc is soldered with No. 8 alloy, by the aid of the muriate or chloride of zinc, and the copper bit. Lead, 4 to 8, *F, d, e*, implies that lead is soldered with alloys varying from No. 4 to 8, and that it is fluxed with tallow, the heat being applied by pouring on melted solder, and the subsequent use of the heated iron, not tinned; but in general one only of the modes of heating is selected, according to circumstances.

Iron, cast-iron and steel, 8, B, D, if thick, heated by *a, b*, or *c*, and also by *g*. See page 190.

Tinned iron, 8, G, D, *f*.

Gold and silver are soldered with pure tin, or else with 8, E, *a, g*, or *h*.

Copper and many of its alloys, namely, brass, gilding metal gun metal, &c., 8, B, C, D; when thick, heated by *a, b, c, e*, or *g*, when thin by *f*, or *g*.

Speculum metal, 8, B, C, D, the heat should be cautiously applied, the sand bath is perhaps the best mode.

Zinc, 8, C, *f*.

Lead and lead pipes, or ordinary plumber's work 4 to 8 F, *d*, or *e*.

Lead and tin pipes, 8, D, and G, mixed, *g*, and also *f*.

Britannia metal, C, D, *g*. See page 189.

Pewters, the solders must vary in fusibility according to the fusibility of the metal, generally G, and *i*, are used, sometimes also G, and *g*, or *f*.

Lead is united without solder by pouring on red-hot lead, and employing a red-hot iron *d, e*.

Iron and brass are sometimes burned, or united by partial fusion, by pouring very hot metal over or around them. See page 214.

ALLOYS AND THEIR MELTING HEATS.

FLUXES.

No.	1	1	Tin	25	Lead	558	Fahr.		A. Borax.
2	1	"	10	"	541	"			B. Sal-am. or mur. of amm.
3	1	"	5	"	511	"			C. Muriate or chlor. of zinc.
4	1	"	3	"	492	"			D. Common resin.
5	1	"	2	"	441	"			E. Venice turpentine.
6	1	"	1	"	370	"			F. Tallow.
7	1	$\frac{1}{2}$	"	1	334	"			G. Gallipoli oil, or common
8	2	"	1	"	340	"			[sweet oil.
9	3	"	1	"	356	"			MODES OF APPLYING HEAT.
10	4	"	1	"	365	"			a. Naked fire.
11	5	"	1	"	378	"			b. Hollow furnace or muffle.
12	6	"	1	"	381	"			c. Immersion in melted so. d.

ALLOYS AND THEIR MELTING HEATS							MODES OF APPLYING HEAT.	
13	4	Lead	4	Tin	1	Bismuth	320 Fahr	<i>d.</i> Melted solder or metal poured n
14	3	"	2	"	1	"	310 "	<i>e.</i> Heated iron, not tinned.
15	2	"	2	"	1	"	292 "	<i>f.</i> Heated copper tool, tinned
16	1	"	1	"	1	"	254 "	<i>g.</i> Blow pipe flame
17	2	"	1	"	2	"	236 "	<i>h.</i> Flame alone, generally alcohol.
18	3	"	5	"	2	"	202 "	<i>i.</i> Stream of heated air.

TO REFINE SWEEPINGS CONTAINING GOLD OR SILVER.—To 8 ozs. of the dirt, which has been washed and burnt, add salt, 4 ozs.; pearlash 4 ozs.; red tartar 1 oz.; saltpetre $\frac{1}{2}$ oz., mix thoroughly in a mortar, melt in a crucible, and dissolve out the precious metals in a button.

TO FUSE GOLD DUST.—Use such a crucible as is generally used for melting brass; heat very hot; then add your gold dust mixed with powdered borax;—after some time a scum or slag will arise on the top which may be thickened by the addition of a little lime or bone ash. If the dust contains any of the more oxidizable metals, add a little nitre, skim off the slag or scum very carefully; when melted grasp the crucible with strong iron tongs; and pour off immediately into cast iron moulds, slightly greased. The slag and crucibles may be afterwards pulverized, and the auriferous matter recovered from the mass through cupellation by means of lead.

TO RECOVER GOLD FROM QUARTZ.—Pulverize the quartz rock as usual, and fuse the mass with lime and oxide of iron. When fused, immerse thin plates of wrought iron in the mixture. The plates soon become coated with a thin film of gold, and are then withdrawn and immersed in a bath of melted lead, which removes the adhering gold, when the plates can be at once returned to the fused quartz and the operation repeated as frequently as the case may require. Another method, when the metal is disseminated through quartz pyrites or lead, is to pulverize the ore as usual and wash the whole with a stream of water, which carries away the lighter portions of sand, leaving the heavy metal behind. It is further freed from impurities by being amalgamated with quick-silver, which is afterwards distilled off. In this state it generally contains from 2 to 10 per cent. of silver or tellurium. It is further refined by being finely granulated and boiled with concentrated sulphuric acid until every other constituent is boiled out. Gold by being alloyed, loses much of its ductility and malleability, but gains in fusibility and hardness. Gold alloys are assayed in two ways, first, by rubbing the article on a touchstone (which is a velvety, black flinty variety of jasper) so as to make a metallic streak, which is touched with *aqua regia*, and the effect is compared with that of a similar streak made by an alloy of known composition. By this means an experienced operator can estimate the amount of alloy in any mixture correctly within one per cent. Full information regarding the second process can be seen under the article on **REFINING GOLD AND SILVER.**

APPLYING HEAT.

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GOLD ALLOYS. The "New Standard" for watch cases, &c., is 18 carats of fine gold and 6 of alloy. No gold of inferior quality can receive the "Hall mark"; and gold of lower quality is generally described by its commercial value. The alloy may be entirely silver, which will give a green color, or entirely copper for a red color, but the copper and silver are more usually mixed in one alloy according to the taste of the jeweller. It will be understood that these are all made with fine gold, fine silver, and fine copper, direct from the refiner. Gold of 22 carats fine being so little used, is intentionally omitted. 1. *Gold of 18 carats, of yellow tint.* Gold 15 dwt, silver, 2 dwt, 18 grs, copper, 2 dwt 6 grs, 2. *Gold of 18 carats, red tint.* Gold 15 dwt, silver, 1 dwt 18 grs, copper, 3 dwt 6 grs. 3. *Spring gold of 16 carats.* Gold 1 oz. 16 dwt, silver, 6 dwt. copper, 12 dwt. This, when drawn or rolled very hard, makes springs little inferior to steel; 4 *Jewellers' Fine Gold, yellow tint, 16 carats nearly.* Gold, 1 oz. silver, 7 dwt. copper, 5 dwt, 5. *Gold of red tint, 16 carats.* Gold, 1 oz. silver, 2 dwt. copper, 8 dwt. Gold alloys in great variety will be found by consulting the "Jewellers' Department" pages 153, 154, 155 and 156.

SMELTING OF COPPER.—After the ore is raised from the mine, it is freed from its matrix and sorted, the purest portions being broken into pieces the size of a nut. The first calcination is effected in a reverberatory furnace, the heat not being raised too high. At the end of 12 hours the ore is converted into a black powder, containing sulphide of copper, oxide and sulphide of iron, and earthy impurities. The roasted ore is next fused with a quantity of silicious slag, by which means it is converted into a fusible slag consisting of silicate of iron and sulphides of iron and copper, which sink through the slag, forming at the bottom a heavy mass, termed a *matt*. The matt thus procured is, while melted, run into water, by which it is granulated. The product obtained is called *coarse metal*. It is roasted once more for twenty-four hours, by which means the larger proportion of the sulphide of iron is converted into oxide. It is then calcined with some copper ore known to contain oxide of copper and silica. The oxide of copper transforms any remaining sulphide of iron into oxide, which is taken up by the silica to form a slag, through which the sulphide of copper sinks. This matt contains about 80 per cent. of copper, and is known by the name of *fine metal*. It is cast into pigs, the lower portions of which contain most of the impurities; the metal extracted from the upper portions being known in the market as best selected copper. The fine metal has now to be freed entirely from sulphur by a final calcination, at a heat just short of that required to fuse it. During the process the metal becomes oxidized at the surface. The oxide thus formed decomposes the rest of the sulphide, sulphurous acid escaping, and metallic copper remaining behind. The metal obtained is run off into moulds, forming ingots full of bubbles, from the escape of the sulphurous acid gas. These ingots, which are known as *pimple*, or blistered copper, from their peculiar appearance, have now to undergo the process of refining. They are placed in a reverberatory furnace, and kept in a melted state for upwards of 20 hours, to oxidize the last traces of foreign metals. Slags are formed on the surface and skimmed off. And a

great deal of oxide is produced which is absorbed by the metal. To reduce this oxide, the surface of the melted metal is covered with anthracite or charcoal, and towards the last a young tree is thrust in. This process, which is called *poling*, disengages the whole of the oxygen from the oxide diffused through the mass. The above is, as nearly as possible, the method of copper-smelting, as employed in England, the processes adopted in Saxony and North America being nearly identical with it, the difference merely being modifications to suit the various impurities contained in the ore. When the ore consists of oxide or carbonate of copper only, it is reduced to the metallic state by simple fusion with charcoal and subsequent *poling*.

SMEETING OF LEAD.—The ore having been brought to the surface, is first sorted by hand, the purest portions being set aside ready for smelting. The rest is broken by hammers into lumps as large as a walnut, and again sorted. The remainder is then crushed in a mill, and sifted through coarse sieves, the coarser portions being set aside for the stampers, and the finer being subjected to the process of *jigging*. This consists in plunging a sieve containing the ore into water, and shaking it dexterously, so that the smallest particles pass through, leaving the larger pieces in the sieve, with the lightest and least metallic portions uppermost. If the sorted galena be tolerably free from gangue, about $1\frac{1}{2}$ ton of the ore is mixed with 1-15th to 1-40th its weight of lime, and heated to dull redness in a reverberatory furnace, through which a current of air is passing. By this means a large portion of the sulphur is burnt off as sulphurous acid, oxide of lead and sulphate of lead being formed, and much of the ore remaining undecomposed. When the roasting has been carried sufficiently far, the furnace doors are shut and the heat is raised. The sulphat and oxide of lead re-act on the undecomposed sulphide, a large quantity of sulphurous acid is formed, which passes off, leaving large quantities of metallic lead behind. The fire is now damped, and a quantity of lime thrown in, which forms a very infusible slag, allowing the metallic lead to be drawn off into moulds. The slag, which contains a large proportion of lead, is smelted with an additional portion of ore. Lead is refined by being melted in a shallow pan in a reverberatory furnace. By this operation any tin or antimony it may contain is oxidized and removed as skimmings. When a ladleful of the lead under this operation cools with a peculiar crystalline surface, the process is discontinued, and the metal is run off into pigs. For some purposes, such for instance as the making of red lead for the manufacture of flint glass, it is necessary that the lead should be almost chemically pure, as a proportion of copper for instance, amounting only to a few grains per ton, would color the glass and spoil the batch. Silver may be profitably extracted from lead, even when it contains only three or four ounces to the ton, by Pattinson's process. This process depends upon the fact that, as lead solidifies, the first portions that crystallize are pure lead. The operation is, therefore, performed by melting the metal in an iron pot and allowing it to cool gradually; as it cools, the crystals of pure lead are removed by a perforated ladle, and the process continually repeated with fresh portions of lead until the mass con-

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tains about 300 ounces to the ton. It is then submitted to *cupellation*. See *REFINING GOLD AND SILVER*, page 164.

MANUFACTURE OF IRON.—The preparation of the ore is effected in a very simple manner, either by pounding or levigating, to separate the clay and silica, or other impurities, or by roasting, to draw off sulphur and carbonic acid, and to render the ore more easily crushed. The extraction of the metal from the ore was formerly effected by means of charcoal, in what was termed a Catalan forge, but it is only used now in a few instances. On account of the loss of metal during the process, it will be better to describe the usual method of smelting ores in England by the blast-furnace. A blast-furnace consists of a long cone inverted upon a shorter cone, at the bottom of which is a vertical passage called the crucible, into which are inserted three pipes called tuyères, through which the blast is conveyed; also a larger opening, through which the slag may be withdrawn, at intervals. At the bottom is a hole called the tap-hole, usually closed with clay for drawing off the reduced metal when a sufficient quantity is collected. The furnace is fed with coal, limestone and ore from a hole near the top, the charge being renewed from time to time as the materials burn down. The action by which the ore is reduced to the metallic state may be traced as follows. The oxygen of the air of the blast combines with the carbon of the coal to form carbonic acid during the process of combustion. The carbonic acid, during its passage through the rest of the heated fuel, is decomposed, being converted into carbonic oxide. The carbonic oxide, still ascending, meets with the hydrogen and coal-gas, together with which it forms a reducing mixture, abstracting the oxygen of the ore and setting free the iron in a metallic state, which sinks down to the bottom of the furnace, where it comes in contact with the carbon of the coal. With this carbide of iron is formed, increasing the fusibility of the reduced iron to such an extent that the lime, clay, and silica present, which have been converted into a fusible slag, float on the top as an imperfect glass. The slag runs over through the side apertures provided for the purpose, and the metal is withdrawn every 12 or 24 hours through the tap-hole. It is run into moulds consisting of a long channel, from each side of which run shorter ones. The central channel is known as the *sow*, the side ones as the *pigs*, hence the term *pig iron*, as applied to rough cast-iron. Great improvements have lately been made in the process of smelting iron, by the introduction of a heated blast for urging the combustion, and by using the combustible gases issuing from the top of the furnace for heating the blast, or the boilers of the steam-engines used for the blowing machines. These improvements are now in use at most of the principal iron works throughout the kingdom, and an idea of their importance may be gathered from the fact that 15 years ago a yield of 200 tons per furnace was thought to be a large quantity, whereas now, at the Ulverstone and other works, 600 and 650 tons per week is thought an ordinary yield; not only this, but the amount of fuel used has been reduced to one-quarter by the same means. The iron that comes from the furnace is generally much too impure to be used for any but the very roughest castings,

it therefore has to be remelted, to drive off, as much as possible, the uncombined carbon, or graphite, silicon, phosphorus, sulphur, and other impurities. A single refusion converts it into what is termed "No. 2 pig," or a grey iron, a fusible and liquid metal; a second and third still further purifying it from carbon, until it is converted into refined or white iron, in which the whole of the carbon is combined with the metal. This description of cast-iron is only used for conversion into malleable iron, for although it melts easily, it forms a much more pasty mass than some of the intermediate qualities of grey iron, which melt into a more liquid metal, fitting them for casting purposes. Refined iron made from the German spathose ores contains a large quantity of combined carbon and manganese, and crystallizes in large plates. It is termed *spiegel-eisen*, or *mirror iron*, from the brilliancy of its crystalline structure, and is much valued for making steel. Founders are accustomed to divide cast-iron into three or four qualities. No. 1, pig or black cast-iron, which contains a large proportion of uncombined carbon; No. 2, or grey cast-iron, which contains more combined carbon; No. 3, or mottled, which contains only a few grains of uncombined carbon, here and there, giving it a mottled appearance; No. 4, or refined iron, in which the whole of the carbon is combined. No. 4, is very hard and brittle, and is fit for puddling or conversion into malleable or wrought-iron. This is effected by bringing an ingot of refined iron to a state of fusion in a reverberatory furnace, taking care to avoid the contact of fuel. The heat is continued until the ingot parts with its carbon, which is assisted by throwing on it scales of oxide, if produced in the forge. As the carbon burns off, the ingot becomes more and more pasty, until at length it is converted into a granular sandy mass. The heat is now raised until it becomes very intense, and the air is excluded by closing the damper and doors. The metal begins to agglomerate into round masses, or blooms, which the puddler collects on the end of an iron rod, and subjects, while still hot, either to the action of a hammer or to a powerful press, called a sloughing press, which squeezes out the slag and other impurities, and forces the particles of iron closer together. The iron is then rolled into bars, and forms what is called homogeneous iron, a quality of metal much used when great hardness is required. It is distinguished by its granular texture when notched and broken. It is much used for the tops of railway bars, and for the wearing surfaces of railway wheels. Where the fibrous quality of iron is required, it is cut into lengths, after the first process of rolling, then piled longitudinally, heated in a reverberatory furnace, and hammered out. This process is repeated several times. Fibrous iron has a fracture like a piece of cane, and is used where resistance to a pulling strain is required, such as anchors, chains, &c. Railway bars are mostly made with the interior of the rail of fibrous iron, to bear the weight of passing trains, while the exteriors are made of granular iron to bear the wearing action of the wheels. The malleable iron of commerce is nearly pure, and may be taken as a type of iron for metallurgical purposes. Wrought-iron is of bluish white color; it is hard and lustrous when polished, and, when rubbed forcibly, it emits a peculiar odour. Its specific gravity is 7.7 to

as possible, the sulphur, and what is termed metal; a second it is converted the carbon is t-iron is only ough it melts e of the intere liquid metal, ande from the mbined carbon It is termed its crystalline Founders are ultities. No. 1, tion of uncom- ins more com- y a few grains bttled appear- f the carbon is t for puddling s is effected by in a reverber- el. The heat hich is assisted in the forge. nd more pasty, ly mass. The and the air is etal begins to e puddler col- still hot, either ed a sloughing ties, and forced en rolled into e quality of It is distin- broken. It is e wearing sur- ty of iron is ss of rolling, y furnace, and mes. Fibrous ere resistance ns, &c. Rail- rail of fibrous e exteriors are e wheels. The e taken as a on is of bluish ,when rubbed avity is 7.7 to

7.9, and it requires the most intense heat of a wind furnace to melt it.

SMELTING OF ANTIMONY.—The reduction of antimony to the reguline state consists of two operations. The crude ore is first melted in an inclined plane, in a reverberatory furnace. The melted sulphide fuses and flows away from the slag, or *gangue* as it is called. The sulphide is again roasted, and mixed with carbonate of soda and charcoal. On heating this mixture in a crucible, a quantity of the metal is formed at the bottom. The unreduced oxy-sulphide, which remains on the top is afterwards used for preparing Kerme's mineral. It is never used alone in the arts, but always in conjunction with other metals, to which it imparts a hardening quality and likewise the valuable property of expanding when they cool. *Common type metal* is composed of 4 parts lead and 1 of antimony. *Musie type* contains in addition a small portion of tin.

SMELTING OF TIN.—To extract the metal, the ore is first stamped or washed, to get rid of the lighter particles of sand or earth adhering to it. It is then roasted to free it from arsenic and sulphur, and again washed to carry off the sulphate of copper and oxide of iron. The washed ore is mixed with from one-fifth to one-eighth its weight of powdered anthracite, or charcoal, and a small portion of lime to form a fusible slag with any of the remaining gangue. The charge is placed in the hearth of a low crowned reverberatory furnace, and the doors are closed up. Heat is applied very gradually for five or six hours, care being taken to raise the temperature high enough to cause the carbon to reduce the tin without melting the silicious gangue, which would form with the binoxide an enamel too troublesome to remove. When nearly all the tin is reduced, the heat is raised considerably, the slags being thus rendered fluid and capable of floating on the surface of the melted metal. The tin is then run off into cast-iron pans from which it is ladled off into moulds to form ingots. The tin thus procured is far from being pure, it is therefore submitted to the process of ligation, which consists in heating the ingots to incipient fusion. By this means the purer tin, which fuses at a comparatively low heat, separates, running down and leaving the impure portions behind. The less fusible portion, when re-melted, forms *block tin*, and the part which has run out is again melted and run out with wet stakes. The steam thus formed bubbles up to the surface, carrying with it all the mechanical impurities contained in the tin. The mass is then skimmed and allowed to cool. When just about to set, the upper half is ladled out, the other metals and impurities having sunk into the bottom half, from the tendency that this metal has to separate from its alloys. The finest quality of tin is frequently heated to a temperature just short of its melting point. At this heat, it becomes brittle and is broken up into masses, showing the crystals of the metal, and forming what is known as *grain tin*. The formation of crystals is to some extent a guarantee of its purity, since impure tin does not become brittle in this way. English tin generally contains small quantities of arsenic, copper, iron and lead. Tin fuses at 442° Fahr, but it is not sensibly volatilized at that or any higher temperature. For the manufacture of tin plate the best soft charcoal iron is obliged to be used. After it has been rolled and cut to

the requisite size, its surface is made chemically clean by immersion for a few minutes in dilute sulphuric acid. The sheets are then heated to a red heat in a reverberatory furnace, withdrawn, allowed to cool, hammered flat, passed between polished rollers, and are now washed in dilute acid. This preparation is needed to free the surface of the iron from the slightest portion of oxide, to which the tin would not adhere. In order to tin them they are plunged one by one into a vessel of tallow from which they are transferred to a bath of tin. From this they are taken, after a certain time, allowed to drain, and dipped again. The superfluous tin at the edge of the plate is removed by dipping it in the melted tin once more, and detaching it by giving the plate a sharp blow.

ZINC.—In the extraction of zinc from its ores, the blende or calamine is first crushed between rollers and roasted. In the case of the blende this is a tedious process and requires great care. The result in either case is oxide of zinc which is mixed with half its weight of powdered coke or anthracite and introduced into crucibles of peculiar construction. A circular furnace is employed, within which the crucibles are ranged. In the bottom of each crucible is an opening to which a short iron pipe is attached, passing through the bottom of the furnace. To the end of this is affixed a removable tube communicating with a sheet iron-vessel. The hole in the bottom of the crucible having been partially plugged with coke, a charge of ore and coal is introduced, and the top of the crucible luted down. The tube connected with the iron vessel is lowered so as to leave the crucible tube open, and the heat is raised. As soon as the flame at the mouth of the short iron tube begins to turn from white to blue, connection is made with the tube leading to the iron pan, and the zinc gradually distils downwards, partly in powder, and partly in stalactitic masses. The crude metal is remelted, skimmed and cast into ingots.

HARD TINNING COMPOUND.—An alloy of nickel, iron and tin has been introduced as an improvement in tinning metals, by the firm of Blaise & Co., Paris. In an experiment to show the tenacity of the nickel, a piece of cast-iron tinned with the compound was subjected for a few minutes to a white heat under the blast, and, although the tin was consumed, the nickel remained as a permanent coating upon the iron. The proportions of nickel and iron mixed with the tin, in order to produce the best tinning, are 10 ozs. of the best nickel and 7 ozs. of sheet iron, to 10 lbs. of tin. These metals are mixed in a crucible to prevent the oxidation of the tin by the high temperature necessary for the fusion of the nickel; the metals are covered with 1 oz. of borax and 3 ozs. pounded glass. The fusion is complete in half an hour, when the composition is run off through a hole made in the flux. In tinning metals with this composition the workman proceeds in the ordinary manner.

STEEL MANUFACTURE.—Steel is manufactured from pure malleable iron by the process called cementation. The Swedish iron from the Dannemora Mines, marked with the letter L in the centre of a circle, and called "Hoop L" is generally preferred. Irons of a few other marks are also used for second-rate kinds of steel. The bars are arranged in a furnace that consists of two troughs, about fourteen feet long and two feet square. A layer of charcoal-powder

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is spread over the bottom, then a layer of bars, and so on, alternately,—the full charge is about ten tons; the top is covered over first with charcoal, then sand, and lastly with the slush or waste from the grindstone trough, applied wet, so as to cement the whole closely down for the entire exclusion of the air. A coal fire is now lighted below and between the troughs; and at the end of about seven days, the bars are found to have increased in weight, the one hundred and fiftieth part, by an absorption of carbon, and to present, when broken, a fracture more crystalline, although less shining, than before. The bars, when thus converted, are also covered with blisters, apparently from the expansion of the minute bubbles of air between them, this gives rise to the name, *blistered steel*. The continuation of the process of cementation introduces more and more carbon, and renders the bars more fusible, and would ultimately cause them to run into a mass if the heat were not checked. To avoid this mischief a bar is occasionally withdrawn and broken to watch the progress, and the work is complete when the cementation has extended to the centre of the bars. The conversion occupies, with the time for charging and emptying the furnace, about fourteen days. A very small quantity of steel is employed in the blistered state, for welding to iron for certain parts of mechanism, but not for edge-tools. The bulk of the blistered steel is passed through one of the two following processes, by which it is made either into shear-steel or cast-steel. *Shear-steel* is produced by piling together six or eight pieces of blistered-steel, about 30 inches long, and securing the ends within an iron ring, terminating in a bar about 5 feet long by way of a handle. They are then brought to a welding heat in a furnace and submitted to the helve or tilt hammer, which unites and extends them into a bar called *Shear-steel* from its having been used in the manufacture of shears for cloth mills, and also German steel, from having been in former years procured from that country. Sometimes the bars are again cut and welded and called *double-shear steel* from the repetition. This process of working, as in the manufacture of iron, restores the fibrous character, and retains the property of welding: the shear-steel is close, hard, and elastic; it is much used for tools, composed jointly of steel and iron, its superior elasticity also adapts it to the formation of springs, and some kinds are prepared expressly for the same, under the name of *spring-steel*. In making *cast-steel*, about 26 or 28 lbs. of fragments of blistered steel, selected from different varieties, are placed in a crucible made of clay, shaped like a barrel, and fitted with a cover, which is cemented down with a fusible lute that melts after a time, the better to secure the joining. Either one or two pots are exposed to a vivid heat, in a furnace like the brass-founder's air furnace in which the blistered-steel is thoroughly melted in the course of 3 or 4 hours: it is then removed by the workman in a glowing state, and poured into a mould of iron, either 2 inches square for bars, or about 6 x 18 inches, for rolling into sheet-steel. For large ingots the contents of two or more pots are run together in the same mould, but it requires extremely great care in managing the very intense temperature that it shall be alike in both or all the pots. The ingots are re-heated in an open fire much like that of the common forge,

and are passed under a heavy hammer weighing several tons, such as those of iron-works, the blows are given gently at first, owing to the crystalline nature of the mass, but, as the fibre is eliminated the strength of the blows is increased, till it is reduced under the heavy hammer to sizes as small as $\frac{1}{4}$ of an inch square. Smaller bars are finished under tilt hammers, which are much lighter than the preceding, move considerably quicker, and are actuated by springs instead of gravity alone; these condense the steel to the utmost. Rollers are also used, especially for steel of round, half-round, and triangular sections, but the tilt hammer is greatly preferred.

STEEL, BY THE BESSEMER PROCESS.—Mr. Goransson, a Swedish iron master, having fully examined the Bessemer process for making steel, and erected the necessary apparatus at his works at Edskä, after considerable delay in experimenting, has, within a recent period, succeeded in establishing the manufacture of good steel, on a practical scale, and in short devotes his whole establishment to this one process. This steel has been made into engineers' tools, boiler plates, and cutlery; and the improvement must now be regarded as an accomplished commercial fact. Mr. Goransson states, that he has carried out Bessemer's invention to the fullest extent, without ever having had recourse to any of the numerous plans which have been patented by others, under the idea of improving the original simple process. The converting vessel is erected, near the tap hole of the blast-furnace, so that about one ton of fluid pig-iron can be run into the apparatus at a time. The pressure of the blast is from 7 to 8 lbs. to the square inch; and, when continued for 6 or 7 minutes, the whole charge is converted into steel. The fluid steel is discharged into a loam-lined ladle, where it is well stirred, and considerable carbonic oxide disengaged and inflamed. After a short interval of repose, which is probably necessary for the steel to condense from the aerated condition in which it leaves the converting vessel, it is run off from the bottom of the ladle, in a vertical stream from the ingot moulds. The whole time occupied, from the moment the pig-iron leaves the furnace until it is cast in the mould, does not exceed 12 minutes. The loss in weight, including the impurities thrown off, does not exceed 15 per cent., which is only about one-half of the waste incurred in the manufacture of bar-iron by the old system in Sweden. By this improvement, Mr. Goransson states, in a letter to the London *Engineer*, that more than 1000 tons annually of cast-steel can be made with the same quantity of fuel as is now required for making 500 tons of bar-iron. He says: "So completely have we accomplished the object that we now make several tons of large ingots of cast-steel in succession, without a single mishap or failure of any kind. The steel can be made either hard, medium, or soft at pleasure. It draws under the hammer perfectly sound and free from cracks or faults of any kind, and has the property of welding in a most remarkable degree."

PHILLIP'S FIRE ANNIHILATOR.—Consists of a case containing water, within which is a smaller case containing chlorate of potash and sugar. Dipped in the latter is a small tube containing sulphuric acid; when this tube is broken the chlorate of potash

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and sugar become ignited, throwing off large quantities of mixed gases which are non-supporters of combustion; the action is maintained by the water in the outer case becoming heated. The gases are conveyed to the fire by means of a flexible tube fitted with a proper nozzle and stop-cock. I have seen still another kind constructed of copper in quite an elegant style, fitted with shoulder straps, &c., for easy transportation, in which the gases were generated by means of chemicals on the principle of what may be seen every day in the effervescence of carbonic acid gas from the intermixture of seidlitz powders in water. The chemicals being introduced from white and blue paper packages into the water contained in the copper case.

TO REMEDY SLIP OF DRIVING BELTS.—Dab on a little of the sticky oil which oozes away from the bearings of machinery.

TO BEND COPPER AND BRASS PIPES.—Run melted lead into your pipe till full, and you may then bend it gradually into any shape you choose, the pipe may then be heated and the lead melted and run out again.

BORING GUN BARRELS.—Take a piece of rod, cast steel, $\frac{1}{2}$ inch smaller than the interior of the barrel, and a few inches longer, beat one end up something larger than the size of bore, then turn or file it in the shape of an egg, leaving the swell, or centreing part $\frac{1}{20}$ th of an inch larger than the bore. With a saw file, cut longitudinal cuts, $\frac{1}{4}$ th inch apart, laying them the same angle as a rose bit countersink, taking care not to injure the periphery of the tool; harden and temper to straw color.

DRILLING CHINA, GLASS, &C.—To drill china use a copper drill and emery, moistened with spirits turpentine. To drill glass, use a steel drill tempered as hard as possible and camphor and water as a lubricant.

MALLET'S BRASS.—Copper 25.4; zinc, 74.6, Used to preserve iron from oxidizing.

TO PREVENT CORROSION IN LEAD PIPES.—Pass a strong solution of sulphide of potassium and sodium through the inside of the pipe at a temperature of 212, and allow it to remain about ten or fifteen minutes. It converts the inside of the pipe into an insoluble sulphide of lead and prevents corrosion.

TO ENAMEL COPPER VESSELS.—Pulverise finely 12 parts of fluor spar, 12 parts of unground gypsum, and 1 part borax, and fuse together in a crucible; when cold, mix with water to a paste, and apply to the interior of the vessel with a paint brush; when dry the vessel should be thoroughly baked in a muffle or furnace.

SHOEING OF HORSES.—As many parts of the horse's hoof are more tender than others, in the case of such animals as have very tender feet, it is the province of the shoeing smith to give ease to such parts and to throw the weight more upon those parts which are better calculated to support it, thus assisting nature in all her operations, in the animal economy. The horse in raising the fore foot for extension, the stress is put upon the flexor muscles,—in particular, the *Flexor pedis perforans*, the tendon of which is inserted into posterior part of the os pedis, or bone at the foot. The longer the toe of the shoe, and straight, the greater leverage is required against the unyielding edge of the toe. By keeping the

toe a moderate length, and turning up the toe of the shoe a little, it allows the foot to be easily rotated, consequently less stress is thrown upon the flexor muscles and tendons, and more particularly upon the tendon at that part when it passes over the navicular bone; it thus lessens the tendency to navicular disease, and, if so affected, this mode of shoeing will give great relief.

PORTABLE TURKISH BATH.—Make a small circular boiler of copper or tin, and fit the same into an upright tin stand, in which, directly under the boiler, you must leave an aperture to contain a small spirit lamp. The boiler lid must fit tightly and be provided with three small tubes pointing upwards. The boiler being filled with water and the lamp lighted, as soon as the steam gets up, it rushes through these tubes, and the patient, seated on a cane chair, with his or her feet in a pan of warm water, with a suitable cloak tightly fastened around the neck, is speedily enveloped in a cloud of steam. Ten minutes is the time recommended for the duration of the first few baths. It may be afterwards increased, but not beyond half an hour. On getting out of the cloak, plunge into a cold bath for a few minutes, then rub the skin till it is quite dry and glowing with a coarse towel and a pair of good hair-gloves. Persons in health or disease will experience a wonderful recuperative power in the frequent use of this bath, and all will find it incomparably superior to the use of drugs in any form whatever. In this connection a new and very ingenious invention called **SPONGIO PILINE**, is deserving of favourable mention. It consists of wool and small particles of sponge felted together, and attached to a skin of India-rubber, the whole about half an inch in thickness, and of inestimable value as a means of applying cold or tepid water &c., to such exterior parts of the human frame as may be nearest to the seat of pain or disease. The water is sponged over the felted surface, the surplus, if any, wiped off; it is then placed on the skin, and covered over with several folds of bandages, which assist in retaining the heat and moisture, thus attracting healthy blood to the part, from which nature selects such food as is most conducive to expel disease and build up healthy tissue. Nothing is so conducive to health of body, and the eradication of disease therefrom, as pure water when properly applied; and in most beautiful correspondence with natural water we have in the **WATER OF LIFE**, or Truths from the *Divine Word*, that sovereign antidote which alone when applied to the life, can cure the malignant diseases of our spiritual nature, and purify our affections and thoughts with those hallowed influences which come from above.

BLACK LEAD PENCILS.—The best pencils are made by grinding the black lead into a fine impalpable powder, then forming it into blocks by compression without any cementing substance, and finally sawing it up into the square prisms, which, when placed in grooves in wood form the black lead pencils of commerce. The color can be graduated to any desired tinge by the intermixture of very finely ground clay. By the process of Prof. Brodie, the most untractable graphite may be reduced to the finest powder with great ease. The mineral is coarsely powdered and mixed with 1-15th of chlorate of potash, to which mixture is added twice its weight of sulphuric acid. Chloric acid is disengaged, and, after

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the mass has cooled, it is well washed, dried, and heated to redness. During the latter operation, the black lead swells and becomes reduced to so fine a powder that it will swim upon water, a little fluoride of sodium is used to dissolve the silicious impurities. The finest quality is found near Burrowdale in Cumberland, England. It is nearly pure carbon, and perfectly free from grit. It is used principally in the manufacture of lead pencils, the coarser quality being used, when ground, for polishing iron work, glazing gunpowder, as a lubricator for machinery, compounded with four times its weight of lard or tallow, and in the manufacture of crucibles for melting metals, as it is very intractable in an intense heat.

TO POLISH PLASTER OF PARIS WORK.—The addition of 1 or 2 per cent. of many salts, such as alum, sulphate of potash, or borax, confers upon gypsum the property of setting slowly in a mass capable of receiving a very high polish.

TO MAKE PLASTER OF PARIS AS HARD AS MARBLE.—The plaster is put in a drum, turning horizontally on its axis, and steam admitted from a steam boiler; by this means the plaster is made to absorb in a short space of time the desired quantity of moisture, which can be regulated with great precision. The plaster thus prepared is filled into suitable moulds; and the whole submitted to the action of an hydraulic press; when taken out of the moulds, the articles are ready for use, and will be found as hard as marble, and will take a polish like it.

MORÉ METALLIQUE.—Is a beautiful crystalline appearance given to tin plate by brushing over the heated metal a mixture of two parts of nitric acid, 2 of hydrochloric acid, and 4 of water; as soon as the crystals appear, the plate is quickly washed, dried and varnished.

MOTHER OF PEARL WORK.—This delicate substance requires great care in its workmanship, but it may be cut with the aid of saws, files and drills, with the aid of muriatic or sulphuric acid, and it is polished by colethar, or the brown red oxide of iron left after the distillation of the acid from sulphate of iron. In all ornamental work, where pearl is said to be used, for flat surfaces, such as inlaying, mosaic work, &c, it is not real pearl, but mother of pearl that is used.

TO POLISH PEARL.—Take finely pulverized rotten stone and make into a thick paste by adding olive oil then add sulphuric acid a sufficient quantity to make into a thin paste, apply on a velvet cork; rub quickly and, as soon as the pearl takes the polish, wash it.

TO POLISH IVORY.—Remove any scratches or file marks that may be present with finely pulverized pumice stone, moistened with water. Then wash the ivory and polish with prepared chalk, applied moist upon a piece of chamois leather, rubbing quickly.

KEROSENE OR CARBON OIL MANUFACTURE.—Petroleum or rock oil, is a liquid substance, of a dark color, exuding from the earth and containing certain liquid and solid hydrocarbons such as benzole, or benzene, kerosene, paraffine, asphaltum, &c., in a state of solution, in different proportions. It differs greatly in composition, some samples containing solid paraffine and benzole in large quantities, while others do not. Petroleum is separated from its dif-

ferent products by careful distillation at different temperatures. The crude material is first heated in a retort to a temperature of about 100° Fahr. This causes a light oil of a strong odour to pass over into the condenser. The residue is then distilled at about 120° to 160°, the result being burning oil. When this is distilled off, steam is forced into the retort and a heavy oil, fit for lubricating purposes, comes over, a black, tarry mass being left behind. The light oil is now used as mineral turpentine, and as a grease solvent. It is often of a dark color, which is easily removed by agitation first with sulphuric acid and afterwards with soda-lye and water. In many instances this light oil (benzine) is sold for illuminating purposes under the name of Sunlight Oil, Combination Burning Fluid, Lightning Oil, &c. I knew one gentleman in Philadelphia who paid one man over \$3000 for the receipt for making, together with the sole right to manufacture, vend and sell, a compound of this kind in that city. The curious, or those interested will find the receipt under the name of the "Northern Light" under the Grocer's Department in this work. Truth requires me to state that this article requires to be handled with great caution when used for lighting purposes—many lamentable accidents having resulted from a careless use of it. The heavy lubricating oil, when cooled down to 30° Fahr., often yields paraffine in large quantities, which is separated by straining and pressure. The asphaltum may be used for pavements, or mixed with grease as a lubricant for heavy machinery. The most important product is, however, the burning oil, which is now used as a cheap and efficient illuminating agent in nearly every household in this country. An average sample of petroleum contains, according to W. B. Tegetmeier, 20 per cent. of benzine or mineral turps, 55 per cent. of burning oil, 22 per cent. of lubricating oil, and 8 per cent. of carbonaceous and tarry matter.

MACKINTOSH CLOTH.—The material is merely two layers of cotton cemented with liquid India rubber; but the junction is so well effected that the three become, to all intents and purposes, one. The stout and well-woven cloth is coiled upon a horizontal beam like the yard beam of a loom; and from this it is stretched out in a tight state and a nearly horizontal direction; a layer of liquid or rather paste-like solution is applied with a spatula, to a considerable thickness, and the cloth is drawn under a knife edge which scrapes the solution and diffuses it equally over every part of the cloth which may be 30 or 40 yards long. The cloth is then extended out on a horizontal framework to dry; and when dried a second coating is applied in the same way, and a third or fourth coat if necessary. Two pieces, thus coated, are next placed face to face with great care, to prevent creasing or distortion; and, being placed between two wooden rollers, they are so thoroughly pressed as to unite durably and permanently. Cloth, thus cemented and doubled and dried, may be cut and made into garments which will bear many a rough trial, and many a deluging, before rain or water can penetrate.

MANUFACTURE OF CORN STARCH.—*Watt's Patent.* The corn is steeped in water, ranging in temperature from 70° to 140° Fahr., for about a week, changing the water at least once in 24 hours. A

certain amount of acid fermentation is thus produced, causing the starch and refuse of the corn to be easily separated afterwards. The swollen corn is ground in a current of clear soft water, and the pulp passed through sieves, with the water, into vats. In these the starch gradually settles to the bottom, the clear water is then run off by a tap, and the starch gathered and dried in a proper apartment for the purpose.

REFINING OF SUGAR.—Both cane and beet-root sugar are refined on the same principle, by mixture with limewater, boiling with animal charcoal, and filtration through twilled cotton. In some establishments bullock's blood is used to aid in the clarifying. The albumen of the serum becomes coagulated on the application of heat, forming a network, which rises to the top of the liquor, carrying with it a great part of the impurities. The reddish syrup obtained by the first filtration is next passed through filters into large vats, twelve or fourteen feet deep, upon which are laid coarse ticking, coarsely ground animal charcoal, and a second layer of ticking. The syrup is allowed to flow over the surface of the filter, and runs slowly through the charcoal, coming out perfectly colourless. The concentrated syrup is then boiled in *vacuo*, by means of which two important results are arrived at. The viscid liquid would boil in air at 230° Fah., at which temperature a quantity of uncrystallizable sugar would be formed. By performing the operation in a vacuum-pan the boiling point is brought down to 150° or 160°, no formation of uncrystallizable sugar takes place, and a great saving in fuel is effected. When the concentration reaches a certain point, the syrup is transferred to a vessel heated by steam to 170°, and forcibly agitated with wooden beaters, until it forms thick and granular. From the heating-vats it is transferred into inverted conical moulds of the well-known shape, at the bottom of each of which is a movable plug. The syrup is well stirred to prevent the formation of air-bubbles, and then left at rest for several hours, at the end of which time the plug is removed, and the uncrystallized syrup runs out. The loaves are further freed from all colored matter by a portion of perfectly colorless syrup being run through them. They are then dried in a stove and finished for market by being turned in a lathe. *Crushed or granulated sugar* is made by causing the granular syrup to revolve in a perforated drum, by which means the uncrystallizable portion is separated from the crystals by centrifugal force.

THE MARINER'S COMPASS.—The needle or magnet is said to point always to the north, and as a matter of course the other points, as east, west, &c., are easily found by the needle pointing north or south. In certain parts of the world, however, the needle does not point to the north, but is drawn considerably to the right or left of true north. This is called the variation of the compass, and must be known accurately by the navigator in order to correct and steer the right course. For instance in crossing the Atlantic Ocean, the variation of the compass amounts in sailing vessels to 2½ or 2¾ points westerly, and the course steered must be corrected accordingly. Say that you wish to make a due east course, you must steer 2½ or 2¾ points south of that or to the right hand in order to make direct course.

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Off the Cape of Good Hope in the South Atlantic Ocean, strange enough, the variation of the compass in ships bound to India or Australia is $2\frac{1}{2}$ points easterly, and in order to make a due east course it is necessary to steer $2\frac{1}{2}$ to the north or left of her course, while again towards the equator or centre of the globe there is hardly any perceptible variation of the compass at all. The way of finding out how much the compass varies in different parts of the world, is by observations of the sun taken with the compass, and the difference between the true and magnetic or compass bearing is the variation, which must be applied as a correction to the course steered. We have, however, in iron ships or steamers what is called the deviation of the compass to attend to besides the variation. This is the local attraction caused by the iron, and must be carefully understood before steamers or iron ships attempt to go to sea. As in steamers of the Allan or Cunard line, each vessel before proceeding on her first voyage must be carefully swung, and magnets fixed to the deck, besides small chains placed on each side of the compasses in boxes, in order to counteract the attraction of the iron. Thus the compasses are so nicely balanced with the magnets and iron, that it is rare indeed at this day that they get out of order on a trans-Atlantic passage. The consequences to either steamer or sailing ship whose compasses are astray would be terrible to contemplate, even if it were but one-half point, on dark winter nights approaching the land. These difficulties are now happily obviated by the discoveries of modern science, and their application in correcting the compass at sea.

There are, however, other disturbing agencies constantly at work. Heat diminishes the magnetism of the needle; for this reason the best magnetic observatories are kept under ground, and at a low and uniform temperature the year round. Earthquakes and the aurora borealis are fruitful causes of irregularity. Thunder-storms do no injury except when a vessel is struck and its iron acquires so much magnetism as to affect the correct indications of the compass on board. When the sun shows a great number of spots, or even one very large spot, the variations of the needle are greatest. This is accounted for by two theories; first, the revolving east and west electric current of the earth's crust, which are the causes of the earth's magnetism, are caused by the solar radiation of heat, before which the earth revolves east and west, and this must be affected by any change in the solar surface by which this radiation of heat is modified. The second theory contends, that inasmuch as we know from discoveries made by the spectroscopic, that the sun contains enormous masses of iron, which must, from the intense heat, be in a state of incandescence resembling a molten ocean, and as such is inaccessible to magnetic influences; nevertheless, the solar spots being most likely solid islands (composed largely of iron which in this state is susceptible of magnetic influences), floating on the sea of fire, and being in many cases several hundred times larger than our planet, how is it possible for any other than disturbing influences in the needle to proceed from such tremendous agencies? Such influences are instantaneous, and do not require time, as light and sound for instance, for their transmission.

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MAKING ANCHORS.—The anchor smith's forge consists of a hearth of brickwork, raised about 9 inches above the ground, and generally about 7 feet square. In the centre of this is a cavity containing the fire. A vertical brick wall is built on one side of the hearth, which supports the dome, and a low chimney to carry off the smoke. Behind this wall are placed the bellows, with which the fire is urged; the bellows being so placed that they blow to the centre of the fire. The anvil and the crane by which the heavy masses of metal are moved from and to the fire are adjusted near the hearth. The *Hercules*, a kind of stamping machine, or the steam hammer, need not be described in this place. To make the anchor, bars of good iron are brought together to be fagoted; the number varying with the size of the anchor. The fagot is kept together by hoops of iron, and the whole is placed upon the properly arranged hearth, and covered up by small coals, which are thrown upon a kind of oven made of cinders. Great care and good management are required to keep this temporary oven sound during the combustion; a smith strictly attends to this. When all is arranged, the bellows are set to work, and a blast urged on the fire; this is continued for about an hour, when a good welding heat is obtained. The mass is now brought from the fire to the anvil, and the iron welded by the hammers. One portion having been welded, the iron is returned to the fire, and the operation is repeated until the whole is welded in one mass. The different parts of the anchor being made, the arms are united to the end of the shank. This must be done with great care, as the goodness of the anchor depends entirely upon this process being effectively performed. The arms being welded on, the ring has to be formed and welded. The ring consists of several bars welded together, drawn out into a round rod, passed through a hole in the shank, bent into a circle, and the ends welded together. When all the parts are adjusted, the whole anchor is brought to a red heat, and hammered with lighter hammers than those used for welding, the object being to give a finish and evenness to the surface. The toughest iron that can be procured should be used in anchors. Good "Weish mine iron" is suitable; also "scrap iron."

An anchor of the ordinary or Admiralty pattern, the Trotman, or Porter's improved (pivot fluke), the Honiball, Porter's, Aylin's, Rodger's, Mitcheson's and Lennox's, each weighing, inclusive of stock, 27000 lbs., withstood without injury a proof strain of 45000 lbs. In dry ground, Rodger's dragged the Admiralty anchor at both long and short stay; at short stay, Rodger's and Aylin's gave equal resistance; Mitcheson's dragged Aylin's at both long and short stay; and Aylin's dragged the Admiralty at short stay, they giving equal resistance at long stay. In ground under water, Trotman's dragged Aylin's, Honiball's, Mitcheson's, and Lennox's; Aylin's dragged Rodger's; Mitcheson's dragged Rogers, and Lennox's dragged the Admiralty's. The breaking weights between a Porter and Admiralty anchor, as tested at the Woolwich Dockyard, were as 43 to 15.

PRINTING ON GLASS.—A Frenchman, named Wilbaur, has taken

out a patent to use an elastic type for printing on glass, with fluorspar rendered adhesive by some such material as mastic or printers ink; sulphuric acid of suitable temperature is then allowed to act on that portion of the glass. The hydrofluoric acid generated in this way would etch the glass on the places printed on. When completed, the whole is washed off with warm water and lye.

ENGRAVING ON WOOD.—In order to make this subject rightly understood we will state that the log of box is cut into transverse slices, 1 inch in depth, in order that the face of the cut may be on a level with the surface of the printers' type, and receive the same amount of pressure; the block is then allowed to dry, the longer the better, as it prevents accidents by warping and splitting, which sometimes happens after the cut is executed, if too green. The slice is ultimately trimmed into a square block, and if the cut is large, it is made in various pieces and strongly clamped and secured together. The upper surface of the wood is carefully prepared, so that no inequalities may appear upon it, and it is then consigned to the draughtsman to receive the drawing. He covers the surface with a light coat of flake white mixed with weak gum water, and the thinner the coat the better for the engraver. The French draughtsmen use an abundance of flake white, but this is liable to make the drawing rub out under the engraver's hands, or deceive him as to the depth of line he is cutting in the wood. The old drawings of the era of Durer seem to have been carefully drawn with pen and ink on the wood; but the modern drawing being very finely drawn with the pencil or silver point is obliterated easily, and there is no mode of "setting" or securing it. To obviate this danger the wood engraver covers the block with paper, and tears out a small piece to work through, occasionally removing the paper to study the general effect. It is now his business to produce in relief the whole of the drawing; with a great variety of tools he cuts away the spaces, however minute, between each of the pencil lines, and should there be tints washed on the drawing to represent sky and water, he cuts such parts of the block into a series of close lines, which will, as near as he can judge, print the same gradation of tint; should he find he has not done so completely, he can re-enter each line with a broader tool, cutting away a small shaving, thus educating their width and consequently their color. Should he make some fatal error that cannot otherwise be rectified, he can cut out the part in the wood, and wedge a plug of fresh wood in the place, when that part of the block can be re-engraved. An error of this kind in a wood-cut is a very troublesome thing; in copper engraving is scarcely any trouble, a blow with a hammer on the back will obliterate the error on the face, and produce a new surface, but in wood the surface is cut entirely away except where the lines occur, and it is necessary to cut it deep enough not to touch the paper, as it is squeezed through the press upon the lines in printing. To aid the general effect of a cut, it is sometimes usual to lower the surface of the block before the engraving is executed, in such parts as should appear light and delicate; they thus receive a mere touch of the paper in the press, the darker parts receiving

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the whole pressure and coming out with double brilliancy. When careful printing is bestowed on cuts it is sometimes usual to insure this good effect by laying thin pieces of card or paper on the tympan, of the shape needed, to secure pressure on dark parts only.

PAPER FOR DRAUGHTSMEN, &c.—Powdered tragacanth 1 part, water 10 parts; dissolve and strain through clean gauze; then lay it smoothly upon the paper previously stretched upon a board. This paper will take either oil or water colors.

TO PULP STRAW FOR PAPER MAKING.—The straw is placed in a boiler, with a large quantity of strong alkali, and with a pressure of steam equal to from 120 to 150 pounds per square inch, the extreme heat being attained in superheating the steam after it leaves the boiler, by passing it through a coiled pipe over a fire, and thus the silica is destroyed, and the straw softened to pulp, which, after being freed from the alkali by working it in cold water, is subsequently bleached and beaten in the ordinary rag machine.

NEAT'S FOOT OIL.—After the hair and hoofs have been removed from the feet of oxen, they yield, when boiled with water, a peculiar fatty matter, which is known as *Neat's Foot Oil*; after standing, it deposits some solid fat, which is separated by filtration; the oil then does not congeal at 32°, and is not liable to become rancid. It is often mixed with other oils. This oil is used for various purposes, such as harness dressing, oiling tower clocks, &c.

TALLOW OIL.—The oil is obtained from tallow by pressure. The tallow is melted, and when separated from the ordinary impurities by subsidence, is poured into vessels and allowed to cool slowly to about 80°, when the stearine separates in granules, which may be separated from the liquid part by straining through flannel, and is then pressed, when it yields a fresh portion of liquid oil. It is used in soap manufacture, &c.

LARD OIL is obtained from hog's lard by pressure, when the liquid part separates, while the lard itself becomes much harder. According to Braconnet, lard yields 0.62 of its weight of this oil, which is nearly colorless. It is employed for greasing wool, and other purposes.

VALUE OF FUEL.—With equal weights, that which contains most hydrogen ought, in its combustion, to produce the greatest volume of flame when each kind is exposed under like advantageous circumstances. Thus, pine is preferable to hardwood, and bituminous to anthracite coal. To produce the greatest quantity of heat, wood should in every case, be as dry as possible; as usually employed it has about 25 per cent of water mechanically combined with it, causing an entire loss of the heat required for its evaporation. The different volumes of oxygen required for different kinds of coal varies from 1.87 to 3 lbs. for each lb. of coal. 60 cubic feet of air is necessary to furnish 1 lb. of oxygen. Making a due allowance for loss, nearly 90 cubic feet of air are required in the furnace of a boiler for each lb. of oxygen applied to the combustion. *Anthracite coal*. Experiments prove the evaporative power of this coal in the furnace of a steam boiler to be from 7½ to 9½ lbs. of fresh water per lb. of coal; with *Cannel or Parrot coal* the result was 6 to 10 lbs. of fresh water under a pressure of 30 lbs. per square inch, for 1 lb. of coal. *Bitu-*

minous coal burns readily, and generates steam rapidly, leaving a white ash; *Caking coal* is unsuited when great heat is required, as the draught of a furnace is impeded by its caking, but it is applicable for the production of gas and coke; *Splint or Hard coal* kindles less readily than caking coal, but when ignited produces a clear and hot fire; *Cherry or Soft coal* does not fuse when heated, is very brittle, ignites readily, and produces a bright fire with a clear yellow flame, but consumes rapidly. The limit of evaporation, from 212° for 1 lb. of the best coal, assuming all of the heat evolved from it to be absorbed, would be 14.9 lbs. The evaporative power of *Coke* in the furnace of a steam boiler, and under pressure, is from 7½ to 8½ lbs. of fresh water, per lb of coke; that of *charcoal* 5½ lbs. of fresh water per lb. Wood will furnish, when properly charred, 23 per cent of charcoal. The slower the charring process goes on, the greater the production. The evaporative power of 1 cubic foot of pine wood is equal to that of 1 cubic foot of fresh water; or, in the furnace of a steam boiler, and under pressure, it is 4½ lbs. fresh water for 1 lb. of wood. One cord of *hardwood* and 1 cord of *soft wood*, such as the general average in Canada, is equal in evaporative effects to 2000 lbs. of anthracite coal. One cord of the kind of wood used by American river steamers in the West, is equal to 12 bushels, (960 lbs.) of Pittsburg coal; 9 cords cotton, ash and cypress wood are equal to 7 cords yellow pine. The densest woods give the greatest heat, as charcoal generates more heat than flame. The evaporative power of *peat* in the furnace of a steam boiler, and under pressure, is 3½ to 5 lbs. of fresh water for every lb. of fuel. *Bituminous coal* is 13 per cent more effective than *coke* for equal weights, and in England the effects are alike for equal costs. In an experiment under a pressure of 30 lbs. 1 lb. pine wood evaporated 3.5 to 4.75 lbs. water, 1 lb. Lehigh coal, 7.25 to 8.75 lbs. The least consumption of coal yet attained is 1½ lbs. per indicated horsepower. It usually varies in different engines from 2 to 8 lbs. Railway experiments demonstrate 1 ton of Cumberland coal, (2240 lbs) to be equal in evaporating effect to 1.25 tons of anthracite coal, and 1 ton of anthracite to be equal to 1.75 cords pine wood; also that 2000 lbs Lackawanna coal are equal to 4500 lbs. best pine woods.

BLOWING ENGINES FOR SMELTING.—The volume of oxygen in air is different, at different temperatures. Thus dry air at 85° contains 10 per cent less oxygen than when it is at the temperature of 32° and when it is saturated with vapor it contains 12 per cent less. If an average supply of 1500 cubic feet per minute is required in winter, 1350 feet will be required in summer. In the manufacture of *Pig Iron*, with *Coke or Anthracite coal*, 18 to 20 tons of air are required for each ton; with *Charcoal*, 17 to 18 tons are required for each ton, (1 ton of air at 340° = 29.751, and at 60° = 31.366 *cubic feet*.) The *Pressure* ordinarily required for smelting purposes is equal to a column of mercury from 3 to 7 inches. The capacity of the *Reservoir* if dry, should be 15 times that of the cylinder, if single acting, and 10 times if double acting. The area of the *Pipes* leading to the reservoir should be 2 that of the blast cylinder, and the velocity of the air should not exceed 35 feet per second. A ton of pig iron requires for its reduction from the ore 310,000 cubic feet of air, or

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5.3 cubic feet of air for each pound of carbon consumed. Pressure, 7 lbs. per square inch. An ordinary Eccentric Fan, 4 feet in diameter with 5 blades 10 inches wide, and 4 inches in length, set 1-9-16 inches eccentric, with an inlet opening of 17.5 inches in diameter, and an outlet o. 13 inches square, making 870 revolutions per minute, will supply air to 40 tuyeres, each of $1\frac{1}{2}$ inches in diameter, and at a pressure per square inch of 5 inch of mercury. An ordinary eccentric fan blower, 50 inches in diameter, running at 1000 revolutions per minute, will give a pressure of 15 inches of water, and require for its operation a power of 12 horses. Area of tuyere discharge 500 square inches. A non-condensing engine, diameter of cylinder 8 inches, stroke of piston 1 foot, pressure of steam 18 lbs. (mercurial gauge), and making 100 revolutions per minute, will drive a fan, 4 feet by 2, opening 2 feet by 2, 500 revolutions per minute. The width and length of the blades should be at least equal to $\frac{1}{4}$ or $\frac{1}{2}$ the radius of the fan. The inlet should be equal to the radius of the fan; and the outlet, or discharge, should be in depth not less than $\frac{1}{4}$ the diameter, its width being equal to the width of the fan. When the pressure of a blast exceeds .7 inch of mercury per square inch, .2 will be a better proportion for the width and length of the fan than that above given. The pressure or density of a blast is usually measured in inches of mercury, a pressure of 1 lb. per square inch at $60^{\circ} = 2.0376$ inches. When water is used as the element of measure, a pressure of 1 lb. = 27.671 inches. The eccentricity of a fan should be 1. of its diameter. A Smith's forge requires 150 cubic feet of air per minute. Pressure of blast $\frac{1}{4}$ to 2 lbs. per square inch, 1 ton of iron melted per hour in a cupola, requires 3500 cubic feet of air per minute. A finery forge requires 100,000 cubic feet of air for each ton of iron refined. A blast furnace requires 20 cubic feet per minute, for each cubic yard, capacity of furnace.

GOLD MINING IN COLORADO.—From the veins of Gilpin County alone nearly 600 tons of ore are raised daily, or 180,000 tons annually. Nearly 500 lodes have been assayed or mapped in a circle of three miles in diameter; fully a thousand lodes have been recorded, and more or less work performed on each. From fifteen to twenty miles of reputable lodes are known to exist, upon which there is not less than eight miles of shafting, the deepest being 800 feet. There is not less than 20 miles of drifting on these veins, following the ore deposit in the crevices, and the official assays show the ore to be worth from \$40 to \$130 per ton. The tailings, or refuse of ore put through the stamps, are found to be worth \$20 per ton, notwithstanding from 10 to 20 per cent of the precious metal passes down the stream. The average shipments of bullion from this one county verges on \$2,600,000 annually. The machinery required for this immense production consist of 83 stamp mills, 185 engines in place, 4,367 horse power, and 1,597 stamps, of which there are over 800 in use, requiring 1,703 horse power. There are 39 engines used at the shafts of mines for raising ore from the veins and keeping them free from water. These mills contain from 5 to 50 stamps, mostly driven by steam. The ore, broken into fragments, is fed into a battery in which the stamps

are raised and allowed to fall, crushing the ore fine enough to flow through a screen placed in front. Mercury is fed in this battery, and the pulverized ore mixed with sufficient water is then made to flow over wide plates of copper amalgamated with quicksilver. The gold, or part of it, adheres, forming an amalgam with the mercury, which is afterwards scraped off, squeezed hard, and the lump retorted in a close retort of iron for the purpose of vaporizing the mercury and getting the gold almost pure; the retorts being subsequently shipped to the East for minting. Each stamp is calculated to do from $\frac{1}{4}$ to $\frac{3}{4}$ of a ton in 24 hours, requiring about one horse power to each stamp head. Most of the ore is reduced in leased mills abandoned by companies. These mill men charge their customers between \$3 and \$4 per ton for doing this work and returning the retort of gold. The tailings are partially caught in the best mills on blankets, and reworked at a profit; the bulk, however, passes outside, a portion stopping to be shoveled into a pile, the balance going on to the stream. The waste is nearly or quite equal to the gross yield in bullion. The most profitable branch of vein mining and reduction by the *smelting process* was undertaken by Prof. Hill in 1867, in connection with some Boston and Providence capitalists, and is managed with much ability, energy and skill, compensated by enormous profits, of which the outside public know little or nothing, from the vigilance with which all such information is suppressed. From the road side you see from 20 to 30 piles of ore sending forth sulphurous emanations into the air. These piles are first started on a layer of wood, and are run up in a pyramid form some 5 to 6 feet, with a diameter at base of from 16 to 20 feet, and then fired, the sulphur affording the only fuel, after the exhaustion of the wood, to keep the fire going from four to six weeks. This ore has been passed through the sampling works and been paid for, the amount lying thus in piles at one time amounting to, perhaps, \$80,000. After roasting sufficiently to drive off the sulphur, and oxidize a portion of the iron, these piles are cooled and the ore carried to the smelting furnaces, where, under a heavy heat, more sulphur is driven off, and the silica or *gangue* matter is made to unite with the oxide of iron to form a slag. At the end of the smelting some 8 or 10 tons are thus reduced to one called "matte," containing from 1,500 to \$2,000 in the precious metals, and from 40 to 60 per cent of copper. This product is then shipped in bags to Swansea, England, for separation into the several metals contained. The establishment contains three smelting furnaces and three calcining furnaces, capable of reducing from 20 to 25 tons of ore per day. The tailings which are concentrated along the streams, and are also sold to this establishment, average from \$35 to \$40 per ton. These works are doubtless the most profitable of the kind known in the world. In working tolerably high grade sulphuretted ores, if the facilities do not admit of sending them to England, the best way is to erect a common furnace, having the fire surfaces of good soap stone; then, to every 150 lbs of ore, put in one bushel of charcoal and 10 per cent of salt. The ore will readily melt to slag, and will be pretty well desulphurized. The slag can be

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TO EXTRACT SILVER FROM WASTE PRODUCTS.—Mix your refuse
with an equal quantity of wood charcoal, place in a crucible and
submit to a bright red heat, and in a short time a silver button
will be found at the bottom.

RECOVERING SILVER BY THE PATIO PROCESS.—The operation
known by this name is sometimes conducted on an immense
scale. In one instance at the hacienda of Regla near Real de
Monte, there is an establishment the floor of which is $1\frac{1}{2}$ acres in
extent, built in the most substantial manner, slightly sloped to
facilitate the flow of water. The flooring consists of well matched
pine boards, and this vast receptacle sometimes contains as much
as 1000 tons of argentiferous slime, 30 tons of salt, 3 tons sulphate
of copper, and 18,000 lbs. of mercury in various stages of the
amalgamating process. The reason why this takes place in the
well known manner is because there is an affinity or correspon-
dence between the different ingredients employed in the operation.

ON CORRESPONDENCES.—The correspondence referred to above
consists of a nature inseminated or implanted in each substance
by the ALMIGHTY ARCHITECT of the Creation, by virtue of which
such a mutual affinity or sympathy exists between them that
whenever an intermixture takes place, they as it were attract
each other, and rush together in a mutual embrace. The science
of correspondences is a most wonderful and instructive study,
entering in its varied ramifications, so deeply into the inherent
nature of every created thing, that there is nothing, and can be
nothing in the universe but what comes within its consideration.
The transcendent importance of the subject is such that it is
deserving of vastly more elaborate consideration than the transient
notice of a single paragraph, but as it would be a violation of
order to enter into an extended explanation in this place, the
reader is referred to the appendix for further illustration.

MERCURY OR QUICKSILVER.—The ore is cinnabar of a bright ver-
million color. Its specific gravity is 8093. It is produced in
immense quantities at the New Almaden mine in Santa Clara
County, 12 miles from the town of San José, which is 54 miles
from San Francisco, Cal. The process by which the fluid metal
is extracted is one of great simplicity. There are 6 furnaces, near
which the ore is deposited from the mine, and separated according
to its quality; the larger masses are first broken up and then all is
piled up under sheds near the furnace doors. The ore is next
heaped on the furnaces, and a steady though not a strong fire is
applied; as the ore becomes heated the quicksilver is sublimed,
and being condensed it falls by its own weight, and is conducted
by pipes, which lead along the bottom of the furnace to small
pots or reservoirs imbedded in the earth each containing from
1 to 2 gallons of the metal. The furnaces are kept going night
and day, while large drops or minute streams of the pure metal
are constantly trickling down into the receivers; from there it is
carried to the store house and deposited in large cast iron tanks or
vats, the largest of which is capable of containing 20 tons of

quicksilver. Seven or eight days are required to fill the furnaces, extract the quicksilver and remove the residuum. The miners and those who merely handle the quicksilver are not injured thereby, but those who work about the furnaces and inhale the fumes of the metal are seriously affected. Salivation is common, and the attendants on the furnaces are compelled to desist from their labour every three or four weeks, when a fresh set of hands is put on. The horses and mules are also salivated, and from 20 to 30 of them die every year from the effects of the mercury.

CROCUS POWDER FOR POLISHING.—Chloride of sodium and sulphate of iron are well mixed in a mortar. The mixture is then put into a shallow crucible and exposed to a red heat; vapor escapes and the mass fuses. When no more vapor escapes, remove the crucible and let it cool. The color of the oxide of iron produced, if the fire has been properly regulated, is a fine violet; if the heat has been too high it becomes black. The mass when cold is to be powdered and washed, to separate the sulphate of soda. The powder of crocus is then to be submitted to a process of careful elutriation, and the finer particles reserved for the more delicate work. An excellent powder for applying to razor strops is made by igniting together in a crucible, equal parts of well dried green vitrol and common salt. The heat must be slowly raised and well regulated, otherwise the materials will boil over in a pasty state, and be lost. When well made, out of contact with air, it has the brilliant aspect of black lead. It requires to be ground and elutriated, after which it affords, on drying, an impalpable powder, that may be either applied on a strop of smooth buff leather, or mixed up with *hog's* lard or tallow into a stiff cerate.

CEMENTING EMERY TO WOOD.—Melt together equal parts of shellac, white resin and carbolic acid in crystals; add the last after the others are melted.

TO COAT IRON WITH EMERY.—Give the iron a good coat of oil and white lead, then when this gets hard and dry, apply a mixture of glue and emery.

TO CLEAN COTTON WASTE.—Pack the waste in a tin cylinder with a perforated false bottom and tube with stop-cock at bottom. Pour on the waste bisulphide of carbon sufficient to cover, and allow to soak a few minutes, then add more bisulphide, and so on for a time or two, and then squeeze out. By simple distillation, the whole of the bisulphide, or nearly all, can easily be recovered and so be used over again. This will free the cotton completely from grease.

BLOWING OUT STEAM BOILERS.—This should never be done under steam pressure. The safety valve should first be raised until the pressure is all removed by letting the steam escape as rapidly as possible, then the hand hole plate or other device should be opened, and the dirt and sediment will run out with the water. But if the boiler is allowed to cool off, the dirt will settle to the bottom and be fastened on with the heat. The dirt is always on the top of the water when there is any pressure of steam on it.

BOILER SCALE.—Sal soda, 40 lbs., gum catecha, 5 lbs., sal ammoniac 5 lbs., is strongly recommended by an experienced person

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for removing boiler scale, one pound of the mixture being added to each barrel of water in the tank; after scale is removed use sal soda alone. By the use of 10 lbs. soda per week a boiler 26 feet long and 40 inches diameter was cleaned from scale equal to a new boiler.

MILDEW ON SAILS can be prevented by soaping the mildewed parts and then rubbing in powdered chalk. The growth of the mildew fungus can be prevented by steeping the canvas in an aqueous solution of corrosive sublimate. *Another way.* Slacked lime 2 bushels, draw off the lime water, and mix it with 120 gals. water, and with blue vitriol $\frac{1}{4}$ lb.

TO MEND CRACKED CAST-IRON VESSELS.—Drill a hole at each extreme end of the crack, to prevent its further extension, plug rivet the holes with copper, and, with fine iron filings saturated with urine, caulk the crack. Four parts of pulverized clay and one part of iron filings made into a paste with boiling linseed oil and applied hot is a good cement for the same purpose.

FRENCH PUTTY.—Seven pounds linseed oil and 4 lbs. brown umber are boiled for two hours, and 62 grammes wax stirred in. After removal from the fire $5\frac{1}{2}$ lbs. fine chalk and 11 lbs. white lead are added and thoroughly incorporated; said to be very hard and permanent.

PLATING WITH NICKEL may be effected by placing the object to be plated, either of iron, steel, copper, bronze, zinc or lead, in a boiling neutral solution of zinc chloride containing a salt of nickel and granulated zinc. If the zinc solution is acid, the coating of nickel is dull. A plating of cobalt may be made in the same manner.

FINE BLUE FINISH FOR GUN BARRELS.—Apply nitric acid and let it eat into the iron a little; then the latter will be covered with a thin film of oxide. Clean the barrel, oil and burnish. A very fine appearance is given to gun barrels by treating them with dilute nitric acid and vinegar, to which has been added sulphate of copper. The metallic copper is deposited irregularly over the iron surface; wash, oil and rub with a hard brush.

LIQUID BLACK LEAD POLISH.—Black lead pulverized 1 lb., turpentine, 1 gill, water, $\frac{1}{2}$ gill, sugar 1 oz.

COPPERAS DIP FOR CAST IRON.—Dissolve 10 lbs. of sulphate of copper and add 2 fluid ozs. sulphuric acid.

TO HARDEN METALS.—Iron, 60 parts, chrome, 40 parts, form D composition as hard as the diamond. A high degree of hardness may also be imparted to iron or steel by adding $\frac{1}{4}$ part of silver. Copper may be externally hardened by the fumes of zinc and tin. The specula of Lord Ross's telescope is 1 part tin and 1 part copper, this is as hard as steel, and takes a very high polish; if more than this be added it will scarcely cohere.

GOOD BRASS FOR MACHINERY.—1. Copper, 2 lbs.; tin, $2\frac{1}{2}$ ozs., zinc, $\frac{3}{4}$ oz. 2. *Tough Brass.* Copper, 10 ozs., tin, $1\frac{1}{2}$ ozs., zinc, $1\frac{1}{2}$ ozs. 3. *Wheels and Valves.* Copper, 90 lbs., tin, 10 lbs. 4. *Brass, very tenacious.* Copper, 88.9 parts, tin, 8.3 parts, zinc, 2.8 parts. 5. *Lathe Bushes.* Copper, 80 parts, tin, 20 parts. *Machinery Bearings.* Copper, 88 parts, tin, 12 parts.

PAINT FOR SHEET IRON SMOKE PIPE.—Good varnish $\frac{1}{2}$ gallon, boiled linseed oil $\frac{1}{2}$ gallon, add red lead sufficient to bring to the consistency of common paint. Apply with a brush. Applicable to any kind of iron work exposed to the weather.

BLACK COLOR ON BRASS WORK.—Make a strong solution of nitrate of silver in one dish and nitrate of copper in another. Mix the two together, and plunge in the brass. Now heat the brass evenly till the required degree of dead blackness is acquired. Unrivalled as a beautiful color on optical instruments.

METALLIC BATH FOR TEMPERING.—Use a black lead or cast iron crucible, (of the requisite depth) and place the same, filled with lead, on a fire made of coal or charcoal, and surrounded on all sides by a metallic or brick wall, level, or nearly so, with the top of the crucible; but at a sufficient distance (say 5 or 6 inches) from it to receive the fuel necessary to maintain the fire, in order to keep the lead in a melted state. Let the crucible rest on iron bars, and leave apertures to admit air to the fire. The articles, slightly greased to prevent the adherence of oxide, are immersed in the melted lead (which is kept at a red heat) by means of tongs, two or three pairs being generally used, in order that one or two pieces may be heated while the other is undergoing manipulation by the hardening process. Keep the lead covered with charcoal dust or cinders. This plan is used by many cutlers and file manufacturers for giving the proper degree of heat in the tempering of their wares. The process is highly valued by those who use it. See file manufacture, page 238.

EFFECTS OF HEAT ON VARIOUS BODIES.

Fine Gold melts.....	2590°	Heat, ochry red.....	1500
“ Silver “.....	1250	“ bright “.....	1860
Copper melts.....	2548	“ red visible by day.....	1077
Wrought Iron melts.....	3980	“ white.....	2900
Cast “.....	3479	Mercury boils.....	662
Bright red “ in the dark.....	752	“ volatilizes.....	680
Red hot “ in twilight.....	884	Platinum melts.....	3080
Glass melts.....	2377	Zinc melts.....	740
Common fire.....	790	Highest natural temperature	
Brass melts.....	1900	(Egypt).....	117
Air furnace.....	3300	Greatest natural cold (below	
Antimony melts.....	951	zero).....	56
Bismuth “.....	476	“ artificial “.....	166
Cadmium.....	600	Heat of human blood.....	98
Steel.....	2500	Snow and Salt, equal parts... 0	
Lead.....	504	Ice melts.....	32
Tin.....	421	Water in <i>vacuo</i> boils.....	98
		Furne under steam boiler... 1500	

SHRINKAGE OF CASTINGS.

Iron, small cylind's=1-16th in. per ft	Ditto, in length... $\frac{1}{16}$ in 16 ins.
“ Pipes.....= $\frac{1}{8}$ “ “ ft.	Brass, thin.....= $\frac{1}{8}$ in 9 “
“ Girders, beams,	Brass, thick.....= $\frac{1}{10}$ in 10 “
ect.....= $\frac{1}{8}$ in. in 15 ins.	Zinc.....= 5-16ths in a foot
“ Large cylind-	Lead.....= 5-16ths “ “
ers, the con-	Copper.....= 3-16ths “ “
traction of di-	Bismuth.....= 5-32nds “ “
ameter at top.= 1-16th per foot-	
Ditto at bottom...= 1-12th per foot	

urnish $\frac{1}{2}$ gallon,
to bring to the
sh. Applicable

lution of nitrate
r. Mix the two
brass evenly till
Unrivalled as a

lead or cast iron
ame, filled with
rounded on all
so, with the top
y 5 or 6 inches)
the fire, in order
ible rest on iron
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le, are immersed
means of tongs,
that one or two
ng manipulation
ed with charcoal
rs and file manu-
the tempering of
those who use it

es.
..... 1500
..... 1890
by day..... 1077
..... 2900
..... 662
..... 680
..... 3080
..... 740
temperature
..... 117
cold (below
..... 56
..... 166
lood..... 98
equal parts... 0
..... 22
boils..... 98
team boiler... 1500

... in 16 ins.
... in 9 "
... in 10 "
... 5-16ths in a foot
... 5-16ths " "
... 3-16ths " "
... 5-32nds " "

Green sand iron castings are 6 per cent. stronger than dry, and 30 per cent. stronger than chilled, but when the castings are chilled and annealed, a gain of 115 per cent. is attained over those made in green sand. Chilling the under side of cast iron very materially increases its strength.

IRON MANUFACTURE.—Charcoal 138 bushels, limestone 432 lbs., and ore 2612 lbs., will produce 1 ton of pig iron. In England, temperature of hot blast is 600°, density of blast and of refining furnace $2\frac{1}{2}$ to 3 lbs. per square inch. Revolutions of puddling rolls 60 per minute; rail rolls, 100; rail saw, 800.

HORSE POWER (INDICATRD) REQUIRED FOR DIFFERENT PROCESSES.

Blast Furnace.....	60	Railway rolling train.....	250
Refining ".....	26	Small bar train.....	60
Puddling Rolls with squeezers and shears.....	80	Double rail saw.....	12
		Straightening.....	7

One pound of Anthracite coal in a cupola furnace will melt from 5 to 10 lbs of cast iron; 8 bushels of bituminous coal will melt 1 ton of cast iron. Small coal produces about $\frac{1}{4}$ of the effect of large coal of the same kind

VELOCITIES OF WOOD WORKING MACHINERY.—*Circular Saws* at periphery, 6000 to 7000 ft. per minute; *Band Saws*, 2500 feet; *Gang Saws*, 20 inch stroke, 120 strokes per minute; *Scroll Saws*, 300 strokes per minute; *Planing Machine Cutters* at periphery, 4000 to 6000 feet. Work under planing machine $\frac{1}{8}$ th of an inch for each cut. *Moulding Machine Cutters*, 3500 to 4000 feet; *Squaring-up Machine Cutters*, 7000 to 8000 feet; *Wood Carving Drills*, 5000 revolutions; *Machine Augers*, $1\frac{1}{2}$ in. diam., 900 revolutions; ditto, $\frac{3}{4}$ in. diam., 1200 revolutions; *Gang Saws* require for 45 superficial feet of pine per hour, 1 horse power. *Circular Saws* require 75 superficial feet per hour, 1 horse power in oak or hard wood $\frac{1}{8}$ ths of the above quantity require 1 horse power; *Sharpening Angles of Machine Cutters*. Adzing soft wood across the grain, 30°; *Planing Machines*, ordinary soft wood 35°; *Gauges and Ploughing Machines*, 40°; *Hardwood Tool Cutters*, 50° to 55°.

FLOUR MILL MACHINERY.—For each pair of 4 feet stones, with all the necessary dressing machinery, etc., there is required 15 horses' power. *Stones* 4 ft. diam., 120 to 140 revolutions per minute. *Dressing Machines*, 21 ins. diam., 450 to 500 revolutions per minute. *Elevator*, 18 ins. diam., 40 revolutions per minute. *Creepers*, $3\frac{1}{2}$ ins. pitch, 75 revolutions per minute. *Screen*, 16 ins. diam., 300 to 350 revolutions per minute. 788 cubic feet of water, discharged at a velocity of 1 foot per second, are necessary to grind and dress 1 bushel of wheat per hour=1.49 horses' power per bushel. 2000 feet per minute for the velocity of a stone 4 feet in diam. may be considered a maximum speed.

WATER.—*Fresh Water*. The component parts by weight and measure is, *Oxygen*, 88.9 by weight, and 1 by measure, *Hydrogen*, 11.1 by weight, and 2 by measure. One cubic inch of distilled water at its maximum density of 39°. 83, the barometer at 30 inches, weighs 252.6937 grs., and it is 828.5 times heavier than at-

mospheric air. A cubic foot weighs 998.068 ounces, or 62.37925 lbs. avoirdupois, but for facility of computation the weight is usually taken at 1000 ounces and 62.5 lbs. By the British Imperial Standard, the weight of a cubic foot of water at 62°, the barometer at 30 ins.=998.224 ounces. At a temperature of 212° its weight is 59.625 lbs. Below 39°.83, its density decreases at first very slow, but progressing rapidly to the point of congelation, the weight of a cubic foot of ice being but 57.25.35.84 cubic feet of water weigh a ton. 3913 cubic feet of ice weigh a ton. River or canal water contains $\frac{1}{40}$ th of its volume of gaseous matter; spring or well water $\frac{1}{14}$ th. *Sea Water*—A cubic foot of it weighs 64.3125 lbs., 34.83 cubic feet weigh 1 ton. Sea water contains from 4 to 5½ ozs. of salt in a gallon of water, varying according to locality, and 62 volumes of carbonic acid in 1000 of water. Dr. Arnott estimated the extreme height of the waves of an ocean, cut on the open sea and free from any influence of land, to be 20 feet. The French exploring expedition computed waves of the Pacific to be 22 feet. The average force of the waves of the Atlantic Ocean during the summer months, as determined by Thomas Stevenson, was 511 lbs. per square foot; for the winter months, 2086 lbs. During a heavy gale a force of 6383 lbs. was observed. *Destructive effect of Sea water upon Metals and Alloys per square foot.* Steel 40 grs.; iron 38; copper 9; zinc 8; galvanized iron 1.5; tin 2.

WARMING BUILDINGS OR APARTMENTS—*By low pressure steam* ($1\frac{1}{2}$ to 2 lbs.) or *hot water*.—One square foot of plate or pipe surface will heat from 49 to 100 cubic feet of inclosed space to 75° in a latitude where the temperature ranges from—10°, or 10° below zero. The range from 40 to 100 is to meet the conditions of exposed or corner buildings, of buildings less exposed, as the intermediate ones of a block, and of rooms intermediate between the front and rear. As a general rule, 1 square foot will heat 75 cubic feet of air in outer or front rooms, and 100 in inner rooms. *By High Pressure Steam*—When steam at a pressure exceeding 2 lbs. per square inch is used, the space heated by it will be in proportion to its increase of temperature above that pressure less the increased radiation of heat in its course to the place of application. One cubic foot of water evaporated is required for every 2000 cubic feet of inclosed space.

ASPHALTIC MASTIC.—Is composed of nearly pure carbonate of lime and about 9 or 10 per cent. of bitumen. When in a state of powder it is mixed with about 7 per cent. of bitumeu or mineral pitch. The powdered asphalt is mixed with the bitumen in a melted state along with clean gravel, and consistency is given to pour it into moulds. The asphalt is ductile, and has elasticity to enable it, with the small stones sifted upon it, to resist ordinary wear. Sun and rain do not affect it, wear and tear do not seem to injure it. The pedestrian in many cities in the United States and Canada, can readily detect its presence on the sidewalk by its peculiar yielding to the foot as he steps over it. It is also a most excellent roofing material when rightly applied, it being on record in France that a stout roof of this material withstood the acciden-

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tal full of a stack of chimneys, with the only effect of bruising the mastic, readily repaired.

THINGS WORTH KNOWING.—1. *Rust Joint, quick setting*: Sal ammoniac, pulverized, 1 lb.; flour of sulphur, 2 lbs.; iron borings 80 lbs., mix to a paste with water in quantities as required for immediate use. 2. *Quick setting joint better than the last, but requires more time to set*. Sal ammoniac, 2 lbs; sulphur, 1 lb.; iron filings, 206 lbs. 3. *Air and water-tight cement for casks and cisterns*: Melted glue, 8 parts; linseed oil, 4 parts; boiled into a varnish with litharge; hardens in forty-eight hours. 4. *Marine Glue*: India rubber, 1 part coal tar, 12 parts; heat gently, mix, and add 20 parts of powdered shellac, pour out to cool, when used, heat to about 250°. 5. *Another ditto*. Glue, 12 parts; water sufficient to dissolve; add yellow resin, 3 parts; melt, then add turpentine, 4 parts; mix thoroughly together. 6. *Water-proof varnish for harness*. India rubber, ½ lb.; spirits of turpentine, 1 gal.; dissolve to a jelly, then take hot linseed oil, equal parts with the mass, and incorporate them well over a slow fire. 7. *Blacking for harness*: Beeswax, ½ lb.; ivory black, 2 oz.; spirits of turpentine, 1 oz.; Prussian blue, ground in oil, 1 oz.; copal varnish, ½ oz.; melt the wax and stir it into the other ingredients before the mixture is quite cold; make it into balls, rub a little upon a brush, apply it upon the harness and polish lightly with silk. 8. *Anti-friction grease*: Tallow, 100 lbs.; palm oil, 70 lbs.; boil together; when cooled to 80°, strain through a sieve, and mix with 28 lbs. soda and, 1½ gals. water. For winter take 25 lbs. more oil in place of the tallow. 9. *Another*. Pulverized black lead, 1 part; lard, 4 parts, mix. 10. *Booth's Railway Axle Grease*: Water, 1 gal.; clean tallow, 3 lbs.; palm oil, 6 lbs.; common soda, ½ lb. or tallow, 2 lbs., palm oil, 10 lbs. Heat to about 212°, and stir well until it cools to 70°. 11. *To remove old iron Moulds*: Moisten the part stained with ink, remove this by the use of muriatic acid diluted by five or six times its weight of water, when the old and new stains will be removed. 12. *Whitewash for outside work*: Slack lime, ½ bushel, in a barrel; add common salt, 1 lb.; sulphate of zinc, ½ lb.; sweet milk, 1 gal.; bring to a proper consistence with water, and apply with a white-wash brush. 13. *Asphalt composition*: Mineral pitch, 1 part; bitumen, 11 parts; powdered stone or wood ashes, 7 parts. 14. *Composition for streets and roads*. Bitumen, 16.875 parts, asphaltum, 225 parts, oil of resin, 625 parts and sand 135. Thickness from 1½ to 1½ inches. Asphaltum, 55 lbs., and gravel, 28.7 lbs. will cover an area of 10.75 square feet. 15. *Cement for external use*: Ashes, 2 parts; clay, 3 parts; sand, 1 part; mix with a little oil, very durable. 16. *Cement for Shoemakers and Channelers*: India rubber dissolved to a proper consistency in sulphuric ether. 17. *Mortar*: Lime, 1 part; clean sharp sand, 2½ parts. An excess of water in slacking the lime swells the mortar, which remains light and porous, or shrinks in drying: an excess of sand destroys the cohesive properties of the mass. 18. *Stone mortar*: Cement, 8 parts; lime, 3 parts, and 31 parts of sand. 19. *Brown mortar*: Lime, 1 part, sand, 2 parts, and a small quantity of hair. 20. *Brick mortar*: Cement, 3 parts; lime, 3 parts, sand 27 parts. Lime and sand,

add cement and sand, lessen about $\frac{1}{3}$ in volume when mixed together. 21. *Turkish mortar*: Powdered brick and tiles, 1 part; fine sifted lime, 2 parts; mix to a proper consistency with water, and lay on layers of five or six inches thick between the courses of brick or stone, being useful on massive or very solid buildings. 22. *Interior plastering*—*Coarse stuff*: Common lime mortar, as made for brick masonry, with a small quantity of hair; or by volumes, lime paste (30 lbs. lime) 1 part; sand, 2 to 2 $\frac{1}{4}$ parts; hair 1-6 part. When full time for hardening cannot be allowed, substitute from 15 to 20 per cent. of the lime by an equal portion of hydraulic cement. For the second or *brown coat* the proportion of hair may be slightly diminished. *Fine stuff* (lime putty): Lump lime slaked to a paste with a moderate volume of water, and afterwards diluted to the consistency of cream, and then to harden by evaporation to the required consistency for working. In this state it is used for a *slipped coat*, and when mixed with sand or plaster of Paris it is used for the *finishing coat*. *Gauge stuff* or *Hard Finish* is composed of 3 to 4 volumes of fine stuff and 1 volume of plaster of Paris, in proportions regulated by the degree of rapidity required in hardening for cornices, &c., the proportions are equal volumes of each, fine stuff and plaster. *Stucco* is composed of from 3 to 4 volumes of white sand to 1 volume of fine stuff, or lime putty. *Scratch coat*: The first of 3 coats when laid upon laths, and is from $\frac{1}{4}$ to $\frac{3}{8}$ of an inch in thickness. *One coat work*: Plastering in one coat without finish, either on masonry or laths, that is, rendered or laid. *Two coat work*: Plastering in two coats is done either in a *laying coat* and set or in a *screed coat* or set. The *Screed Coat* is also termed a *Floated Coat*. *Laying* the first coat in two coat work is resorted to in common work instead of *screeding*, when the finished surface is not required to be exact to a straight edge. It is laid in a coat of about $\frac{1}{4}$ inch in thickness. The laying coat, except for very common work, should be *hand-floated*, as the tenacity and firmness of the work is much increased thereby. *Screeds* are strips of mortar, 26 to 28 inches in width, and of the required thickness of the first coat, applied to the angles of a room, or edge of a wall and parallelly, at intervals of 3 to 5 feet over the surface to be covered. When these have become sufficiently hard to withstand the pressure of a straight edge, the interspaces between the screeds should be filled out flush with them, so as to produce a continuous and straight, even surface. *Slipped Coat* is the smoothing off of a brown coat with a small quantity of lime putty, mixed with three per cent. of white sand so as to make a comparatively even surface. This finish answers when the surface is to be finished in distemper or paper. *Hard Finish*: Fine stuff applied with a trowel to the depth of about $\frac{1}{4}$ of an inch.

EARTH DIGGING.—*Number of cubic feet of earth in a ton.* Loose earth 24; coarse sand 18.6. Clay 18.6. Earth with gravel 17.8. Clay with gravel, 14.4. Common soil 15.6. The volume of earth and sand in bank exceeds that in embankment in the following proportions; sand $\frac{1}{2}$, clay $\frac{1}{3}$, gravel $\frac{1}{4}$, and the volume of rock in embankments quarried in large fragments exceeds that in bank fully one half.

when mixed to tiles, 1 part; cy with water, the courses of solid buildings. ne mortar, as of hair; or by 2 to 24 parts; ot be allowed, n equal portion the proportion putty): Lump ater, and after- n to harden by g. In this state sand or plaster or Hard Finish volume of plas- free of rapidity rtions are equal is composed of ne stuff, or lime upon laths, and ork: Plastering laths, that is, o coats is done at or set. The g the first coat work instead of l to be exact to ch in thickness. should be hand- much increased nches in width, ed to the angles ervals of 3 to 5 ave become suf- ight edge, the t out flush with t, even surface. at with a small white sand so as h answers when Hard Finish: but $\frac{1}{2}$ of an inch. Loose ith gravel 178. volume of earth n the following lume of rock in s that in bank

TO STAIN OR COLOR GLASS.—For *amethyst*, oxide of manganese is used; for *blue*, oxide of cobalt; for *brown*, oxide of iron; for *green*, black oxide of copper; for *purple*, oxide of gold; for *ruby red*, sub-oxide of copper; for *white*, oxide of tin; for *yellow*, oxide of silver, &c. These substances pure and well powdered, are either added to the melted contents of the glass-pot, or are applied to the surface as in glass staining. See page 131.

TO GILD LETTERS ON MARBLE.—Apply first a coating of size and then several successive coats of size thickened with finely powdered whiting until a good face is produced. Let each coat become dry and rub it smooth with fine glass paper before applying the next. Then go over it thinly and evenly with gold size and apply the gold leaf, burnishing with an agate, several coats of leaf will be necessary to give a good effect.

ARRANGEMENT OF LAPIDARIES' CUTTING PLATES.—1. Soft iron (very thin) with diamond dust in oil; 2. Pewter with coarse emery and water; 3. Pewter, with fine emery and water; 4. Wood with sand and water; 5. Pewter, with rotten stone and water; 6. Leather with putty powder slightly wet.

MEASUREMENT OF STONE OR BRICK WORK.

1 Perch, Masons' or Quarrymen's Measure.

$$\left. \begin{array}{l} 16\frac{1}{2} \text{ feet long} \\ 16 \text{ inches wide} \\ 12 \text{ " high} \end{array} \right\} = \left\{ \begin{array}{l} 22 \text{ cubic feet. To be measured in wall.} \end{array} \right.$$

$$\left. \begin{array}{l} 16\frac{1}{2} \text{ feet long,} \\ 18 \text{ inches wide,} \\ 12 \text{ " high} \end{array} \right\} = \left\{ \begin{array}{l} 24.75 \text{ cubic feet. To be measured in pile.} \end{array} \right.$$

1 cubic yard = 3 feet + 3 feet + 3 feet = 27 cubic feet. The cubic yard has become the standard for all contract work of late years. Stone walls less than 16 inches thick count as if 16 inches thick to masons; over 16 inches thick, each additional inch is counted.

NUMBER OF BRICK REQUIRED IN WALL PER SQUARE FOOT FACE OF WALL.

Thickness of wall		Thickness of wall.	
4 inches	7 $\frac{1}{2}$	24 inches	46
8 "	15	28 "	52 $\frac{1}{2}$
12 "	22 $\frac{1}{2}$	32 "	60
16 "	30	36 "	67 $\frac{1}{2}$
20 "	37 $\frac{1}{2}$	42 "	75

Cubic yard = 600 Bricks in wall.

Perch (22 cubic feet) = 500 Bricks in wall.

To pave 1 sq. yard on flat requires 41 Bricks

" " " edge " 68 "

For mortar, plaster, &c., of all kinds, see page 271.

TO BLEACH FIXED OILS.—Shake strongly for some minutes, 300 parts of the oil with 40 parts water containing 1 part permanganate of potassa; allow the mixture to stand in a warm place for some hours, and then filter. This renders the oil colorless. *To purify oil.* Into 1000 parts by weight of oil, put a mixture of 6 parts solution of ammonia and 6 parts water, agitate the barrel well until the alkali is perfectly mixed, which may be done in 15 minutes. The barrel is then sealed hermetically, and after 3 days repose, the oil is decanted and filtered. The residue is used for the manufacture of soap. *To Clarify Coal Oil.*—Place in a close vessel 100 lbs. crude

coal, 25 qts. water, 1 lb. chloride of lime, 1 lb. soda, and $\frac{1}{2}$ lb. oxide of manganese. The mixture is violently agitated, and allowed to rest for 24 hours when the clear oil is decanted and distilled. The 100 lbs. coal oil are to be mixed with 25 lbs. resin oil; this is one of the principal points in the manipulation; it removes the gummy parts from the oil, and renders them inodorous. The distillation spoken of may terminate the process, or the oils may be distilled before they are defecated and precipitated.

TO OBTAIN COMMERCIAL ANTIMONY.—Fuse together 100 parts sulphuret of antimony, 40 parts metallic iron, and 10 parts dry crude sulphate of soda. This produces from 60 to 65 parts of antimony, besides the scoria or ash which is also valuable. *Metallic Antimony.* Mix 16 parts sulphuret of antimony and 6 parts cream of tartar, both in powder; put the mixture, in small quantities at a time, into a vessel heated to redness; when reaction ceases, fuse the mass and after 15 minutes, pour it out and separate the metal from the slag. The product is nearly pure.

TO DYE LEATHER YELLOW.—Picric acid gives a good yellow without any mordant; it must be used in very dilute solution, and not warmer than 70° Fahr, so as not to penetrate the leather.

GREEN DYE FOR LEATHER.—Aniline blue modifies picric acid to a fine green. In dyeing the leather, the temperature of 85° Fahr., must never be exceeded.

TO CLEAN OSTRICH FEATHERS.—Cut some white curd soap in small pieces, pour boiling water on them and add a little pearlash. When the soap is quite dissolved, and the mixture cool enough for the hand to bear, plunge the feathers into it, draw the feathers through the hand till the dirt appears squeezed out of them, pass them through a clean lather with some blue in it, then rinse them in cold water with blue to give them a good color. Beat them against the hand to shake off the water, and dry by shaking them near a fire. When perfectly dry curl each fibre separately with a blunt knife or ivory paper folder. To dye feathers, see page 101.

TO CLEAN FURS.—For dark furs: warm a quantity of new bran in a pan, taking care that it does not burn, to prevent which it must be briskly stirred. When well warmed, rub it thoroughly into the fur with the hand. Repeat this two or three times; then shake the fur, and give it another sharp brushing until free from dust. For white furs, lay them on a table, and rub well with bran made moist with warm water, rub until quite dry, and afterwards with dry bran. The wet bran should be put on with flannel and the dry with book muslin. Light furs in addition to the above, should be well rubbed with magnesia or a piece of book muslin after the bran process, against the way of the fur.

MUCH BUTTER FROM LITTLE MILK.—Take 4 ozs. pulverized alum $\frac{1}{2}$ oz. pulverized gum arabic, and 50 grs. of pepsin; place it in a bottle for use as required. A teaspoonful of this mixture added to a pint of milk, will, upon churning, make a pound of butter. Agents are now selling this secret for \$5.

BEST HEEL BALL.—Melt together beeswax, 2 lbs., suet, 3 ozs., stir in ivory black, 4 ozs., lamp black, 3 oz., powdered gum arabic, 2 oz., powdered rock candy, 2 oz., mix and when partly cold pour into tin and leaden moulds.

ESTIMATE OF MATERIALS AND LABOR FOR 100 SQUARE YARDS OF LATH AND PLASTER.

Materials and Labor.	Three Coats Hard finish	Two Coats Slipped	Materials and Labor.	Three Coats Hard finish	Two coats Slipped.
Lime.....	4 Casks.	3½ Casks.	White Sand	2½ bushels	
Lump Lime	½ "		Nails.....	13 lbs	18 lbs.
Plaster of Paris.....	½ "		Masons.....	4 days	3½ days
Laths.....	2000 "	2000 "	Labourer.,	3 "	2 "
Hair.....	4 bushels	3 bushels	Cartage....	1 "	½ "
Sand.....	6 loads.	6 loads			

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TERRA COTTA MANUFACTURE.—In the terra cotta manufacture of the north of England and Scotland, the purest lumps of fire clay are selected by their color and texture, and used alone without any other clay, while the firms near London prepare more carefully a mixture of clays, which produce a body of better texture. One of the chief difficulties met in manufacturing terra cotta figures and ornamental works is the contraction the clay suffers after it has left the mould; first, in drying; afterwards, in firing. By mixing the clays, a further advantage is gained in the diminished shrinkage, as fire clay terra cotta (that is, unmixed) shrinks in lineal dimensions about 12 per cent from the time it leaves the mould until it leaves the kiln; the mixed clay terra cotta shrinks 6 per cent or less, and red clays shrink 3 per cent. To enhance the durability of the body of terra cotta, a partial vitrification of the mass is aimed at by adding clays and substances which contain a small amount of alkalies which act as a flux to fuse the body harder; also vitrifying ingredients, pure white river sand, old fire brick, ground fine, previously ground clay called "grog," are added in various proportions, amounting even to 25 per cent. They counteract excessive shrinkage, act as vitrifying elements, and keep the color lighter. In the manufacture the mixture of clays is ground under an edge runner to the consistency of flour. The mills have either revolving or stationary pans; the former do the most work. In order to mix and incorporate the different clays, a subsequent careful pugging is required, for which hot water is sometimes used. The mixture, when brought to the proper homogeneous consistency, is placed in a plaster mould, dried near the kilns or otherwise, and baked in a kiln for five or seven days, during which time it is slowly brought to a white heat, and as gradually cooled down again. In order to avoid twisting and warping during the firing, it is necessary, besides complete mixing of clays, that the mould be shaped so as to give a uniform thickness of material throughout, and if the temperature of the kiln be well graded, the homogeneous body will not warp. To cheapen terra cotta building blocks, they are made hollow, and filled, during the construction, with concrete or cement. Although in the kilns the productions are separated from the wares, it is found that the use of sulphurous fuel darkens and tarnishes the surface, and it is to be avoided. This material admits of being used with the greatest facility in the formation of the most elaborate architect-

toral ornaments and other beautiful designs, which can be multiplied to any required extent at a very cheap rate. A piece of four inch column tested at the 1851 Exhibition required a pressure of 400 tons per square foot to crush it, or as much as good granite and two to three times as much as most building stone.

BLASTING ROCKS, &c.—In small blasts 1 lb. of powder will loosen about $4\frac{1}{2}$ tons. In large blasts 1 lb. of powder will loosen about $2\frac{1}{2}$ tons; 50 or 60 lbs. of powder, inclosed in a resisting bag hung or propped up against a gate or barrier will demolish any ordinary construction. One man can bore, with a bit 1 inch in diameter, from 50 to 60 inches per day of 10 hours in granite or 300 to 400 ins. per day in limestone. Two strikers and a holder can bore with a bit 2 ins. in diameter 10 feet per day in rock of medium hardness.

LABOUR ON EMBANKMENTS. *Single horse and cart.* A horse with a loaded dirt cart employed in excavation and embankment, will make 100 lineal feet, or 200 feet in distance per minute, while moving. The time lost in loading, dumping, awaiting, etc., = 4 minutes per load. A medium laborer will load with a cart in 10 hours, of the following earths, measured in the bank: *Gravelly earth* 10, *Loam* 12, and *Sandy earth* 14 cubic yards; carts are loaded as follows: *Descending hauling*, $\frac{1}{2}$ of a cubic yard in bank, *Level hauling* $\frac{2}{3}$ of a cubic yard in bank; *Ascending hauling*, $\frac{1}{3}$ of a cubic yard in bank. *Loosening &c.* In *loam*, a three-horse plow will loosen from 250 to 800 cubic yards per day of 10 hours. The cost of loosening earth to be loaded will be from 1 to 8 cents per cubic yard, when wages are 105 cents per day. The cost of trimming and bossing is about 2 cents per cubic yard. *Scooping.* A scoop load will measure $\frac{1}{10}$ of a cubic yard, measured in excavation. The time lost in loading, unloading and trimming, per load, is $1\frac{1}{2}$ minutes. The time lost for every 70 feet of distance, from excavation to bank, and returning is 1 minute. In *Double Scooping*, the time lost in loading, turning, &c., will be 1 minute; and in *Single Scooping*, it will be $1\frac{1}{2}$ minutes. (Ellwood Morris.)

HAULING STONE.—A cart drawn by horses over an ordinary road will travel 1.1 miles per hour of trip. A 4 horse team will haul from 25 to 36 cubic feet of lime stone at each load. The time expended in loading, unloading, &c., including delays, averages 35 minutes per trip. The cost of loading and unloading a cart, using a horse cram at the quarry, and unloading by hand, when labour is \$1.25 per day, and a horse 75 cents, is 25 cents per perch = 24.75 cubic feet. The work done by an animal is greatest when the velocity with which he moves is $\frac{1}{2}$ of the greatest with which he can move when not impeded, and the force then exerted $\frac{1}{45}$ of the utmost force the animal can exert at a dead pull.

HAY.—270 cubic feet of new meadow hay, and 216 and 243 from large or old stacks, will weigh a ton, 297 to 324 cubic feet of dry clover weigh a ton.

WHEEL GEARING.—The *Pitch Line* of a wheel, is the circle upon which the pitch is measured, and it is the circumference by which the diameter, or the velocity of the wheel is measured. The *Pitch*, is the arc of the circle of the pitch line, and is determined by the

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number of teeth in the wheel. The *True Pitch*, (*chordal*), or that by which the dimensions of the tooth of a wheel are alone determined, is a straight line drawn from the centres of two contiguous teeth upon the pitch line. The *Line of Centres*, is the line between the centres of two wheels. The *Radius* of a wheel is the semi-diameter running to the periphery of a tooth. The *Pitch Radius*, is the semi-diameter running to the pitch line. The *Length of a tooth*, is the distance from its base to its extremity. The *Breadth* of a tooth, is the length of the face of wheel. A *Cog Wheel*, is the general name for a wheel having a number of cogs set upon or radiating from its circumference. A *Mortice Wheel*, is a wheel constructed for the reception of teeth or cogs, which are fitted into recesses or sockets upon the face of the wheel. A *Cog Wheel* is the general term for a wheel having a number of cogs or teeth set upon or radiating from its circumference. A *Mortice Wheel*, is a wheel constructed for the reception of teeth or cogs, which are fitted into recesses or sockets upon the face of the wheel. *Plate Wheels*, are wheels without arms. A *Rack* is a series of teeth set in a plane. A *Sector* is a wheel which reciprocates without forming a full revolution. A *Spur Wheel*, is a wheel having its teeth perpendicular to its axis. A *Bevel Wheel*, is a wheel having its teeth at an angle with its axis. A *Crown Wheel*, is a wheel having its teeth at a right angle with its axis. A *Mitre Wheel* is a wheel having its teeth at an angle of 45° with its axis. A *Face Wheel*, is a wheel having its teeth set upon one of its sides. An *Annular or Internal Wheel*, is a wheel having its teeth convergent to its centre. *Spur Gear*, Wheels which act on each other in the same plane. *Bevel Gear*, Wheels which act upon each other at an angle. When the tooth of a wheel is made of a different material from that of the wheel, it is termed a *cog*: in a pinion it is termed a *leaf*, and in a trundle it is termed a *stave*. A wheel which impels another is termed the *spur, driver, or leader*: the one impelled is the *pinion, driver, or follower*. A series of wheels in connection with each other is termed a *train*. When two wheels act on each other, the greater is termed the *wheel* and the lesser the *pinion*. A *Trundle, Lantern, or Wallower* is when the teeth of a pinion are constructed of round brass solid cylinders set in two discs. A *Trundle* with less than eight staves cannot be operated uniformly by a wheel with any number of teeth. The material of which cogs are made is about one fourth the strength of cast iron. *Buchanan* rules that to increase or diminish the velocity in a given proportion and with the least quantity of wheel-work, the number of teeth in each pinion should be to the number of teeth in its wheel as 1, 3, 59. Even to save space and expense, the number should never exceed 1; 6. The least number of teeth that it is practicable to give to a wheel is regulated by the necessity of having at least one pair always in action, in order to provide for the contingency of a tooth breaking. The teeth of a wheel should be as small and numerous as is consistent with strength. When a *pinion is driven by a wheel*, the number of teeth in the pinion should not be less than eight. When a *wheel is driven by a pinion*, the number of teeth in the pinion should not be less than ten. The number of teeth in a wheel should always be prime to

the number of the pinion, that is, the number of teeth in the wheel should not be divisible by the number of teeth in the pinion without a remainder; this is in order to prevent the same teeth coming together so often as to cause an irregular wear of their faces. An odd tooth introduced into a wheel is termed a *hunting tooth* or *cog*.

TO COMPUTE THE NUMBER OF TEETH REQUIRED IN A TRAIN OF WHEELS TO PRODUCE A GIVEN VELOCITY. *Rule*.—Multiply the number of teeth in the driver by its number of revolutions, and divide the product by the number of revolutions of each pinion, for each driver and pinion.

Example.—If a driver in a train of three wheels has 90 teeth, and makes 2 revolutions, and the velocities required are 2, 10, and 18, what are the number of teeth in each of the other two.

$$10:90::2:18=\text{teeth in 2nd wheel.}$$

$$18:90::2:10=\text{teeth in 3rd wheel.}$$

TO COMPUTE THE DIAMETER OF A WHEEL. *Rule*.—Multiply the number of teeth by the pitch, and divide the product by 3, 1416.

Example.—The number of teeth in the wheel is 75, and the pitch 1, 675 ins: what is the diameter of it?

$$\begin{array}{r} 75 \times 1.6755 \\ \hline =10 \text{ ins.} \\ 3.1416 \end{array}$$

TO COMPUTE THE TRUE OR CHORDIAL PITCH. *Rule*.—Divide 180 by the number of teeth, ascertain the sine of the quotient, and multiply it by the diameter of the wheel.

Example.—The number of teeth is 75, and the diameter 40 inches; what is the true pitch?

$$\begin{array}{r} 180 \\ \hline =20'24' \text{ and sin. of } 20'24'=.04188, \text{ which } \times 40=1.6752 \text{ ins.} \\ 75 \end{array}$$

HOE'S COMPOSITION FOR PRINTERS' ROLLERS.—This consists of glue and molasses, the proportions varying from 8 lbs. of glue in summer, to 4 lbs. in winter for each gallon of molasses. The glue should be placed $\frac{1}{2}$ an hour in a bucket, covered with water, then pour the water off, and allow the glue to soften. Put it into a kettle and heat it until thoroughly melted; if too thick a little water may be added. Lastly, the molasses is added and well stirred in with the glue. When properly prepared an hour's boiling will be sufficient, as too much boiling is apt to candy the molasses. A late improvement consists in the addition of glycerine to the usual mixture. Swab the mould with oil before pouring.

CEMENT FOR PETROLEUM LAMPS.—Boil 3 parts of ressin with 1 part of caustic soda and 5 of water. The composition is then mixed with half its weight of plaster of Paris, and sets firmly in $\frac{1}{2}$ to $\frac{3}{4}$ of an hour. It is of great adhesive power, not permeable to petroleum, a low conductor of heat, and but superficially attacked by hot water.

TO DEDORIZE BENZINE.—Shake repeatedly with plumbate of soda (oxide of lead dissolved in caustic soda), and rectify. The following plan is said to be better. Shake repeatedly with fresh portions of metallic quick silver; let it stand for 2 days, and rectify.

SPECIFIC GRAVITY.—Is the density of the matter of which any body is composed, compared with the density of another body

assumed as the standard, or 1000. This standard is pure distilled water for liquids and solids, and atmospheric air for gaseous bodies and vapors. Thus as gold is 19 and silver 10 times heavier than water, those numbers 19 and 10 are said to represent the specific gravity of gold and silver. The heaviest known substance is iridium, used for pointing gold pens; its specific gravity is 23. The lightest of all liquids has a specific gravity of 0.6, it is called chimogene, and is made from petroleum, it is exceedingly volatile and combustible, being in fact a liquefied gas. Carbonic acid gas or choke damp is 500 times lighter than water, common air, 800, street gas about 2000, and pure hydrogen the lightest of all substances, 12,000 times. The heaviest substance has thus $23 \times 12,000$, or more than a quarter of a million times more weight than an equal bulk of the lightest; and the substance of which comets consist, has by astronomers been proved to be even several thousand times lighter than hydrogen gas.

TO GALVANIZE GREY IRON CASTINGS.—Cleanse the articles in an ordinary chaffing mill, which consists of a barrel revolving on its axis, containing sand; when the sand is all removed, take them out and heat one by one, plunging, while hot, in a liquid composed as follows 10 lbs. hydrochloric acid and sufficient sheet zinc to make a saturated solution. In making this solution, when the evolution of gas has ceased, add muriate, or preferably sulphate of ammonia, 1 lb., and let it stand till dissolved. The castings should be so hot that when dipped in this solution, and instantly removed, they will immediately dry, leaving the surface crystallized like frost work on a window pane. Next plunge them while hot, but perfectly dry, in a bath of melted zinc, previously skimming the oxide on the surface away, and throwing thereon a small amount of powdered sal ammoniac. If the articles are very small, inclose them in a wrought iron basket on a pole, and lower them into the metal. When this is done, shake off the superfluous metal, and cast them into a vessel of water to prevent them adhering when the zinc solidifies.

TO PURIFY PETROLEUM OR KEROSENE OIL.—The distillate or crude burning oil is converted into ordinary burning oil by being placed in a tank when it is violently agitated by forcing air through it, and while thus agitated, $1\frac{1}{2}$ to 2 per cent., sulphuric acid is added, after which the agitation is continued 15 to 30 minutes. The oil is then allowed to settle, when the acid and impurities are removed, and any acid remaining in the oil is neutralized. It is then taken to shallow bleaching tanks, where it is exposed to light and air, and allowed to settle. It is next heated by means of a coil of steam pipe running through it, to expel all gaseous vapours which will ignite at a temperature below 110° Fahr. The oil is now called a *fire test* oil, and is ready to be barreled and sent to market. Kerosene oil is *decolorized* by stirring it up with 1 or 2 per cent. of oil of vitriol, which will carbonize the coloring matter, then with some milk of lime or some other caustic alkali, settling, and re-distilling.

TO FROST POLISHED SILVER.—Cyanide of potassium 1 oz., dissolve in $\frac{1}{2}$ pt. of water. Do not hold the silver in your hands, but use pliers made of lance wood or box wood, and apply the mixture with a brush to the polished surface.

TO RESTORE BURNT CAST STEEL.—Borax $1\frac{1}{2}$ lbs., sal ammoniac $\frac{1}{2}$ lb., prussiate of potash $\frac{1}{2}$ lb., rosin, 1 oz. Pound the above fine, add a gill each of water and alcohol, and boil all to a stiff paste in an iron kettle. Do not boil too long, or it will become hard when cool. The burnt steel is dipped while quite hot in the composition and slightly hammered.

YELLOW DIPPING METAL.—Melt together 2 parts of brass, 1 part copper, with a little old brass, and $\frac{1}{4}$ oz. tin to every lb. of copper. This alloy is almost of the color of gold coin.

SILVERING HOOKS AND EYES, &C.—The small iron articles are suspended in dilute sulphuric acid until the iron shows a bright clean surface. After rinsing in pure water they are placed in a bath of a mixed solution of sulphate of zinc, sulphate of copper and cyanide of potassium, and there remain until they receive a bright coating of brass. Lastly, they are transferred to a bath of nitrate of silver, cyanide of potassium and sulphate of soda, in which they quickly receive a coating of silver.

TO APPLY DECALCOMINE PICTURES.—Varnish the pictures carefully with the prepared varnish, (which can be obtained with the pictures), with an ornamenting pencil, being careful not to get the varnish on the white paper. In a few minutes the picture will be ready to lay on the panel, and the paper can be removed by wetting it, and when thoroughly dry, it should be varnished like an oil painting. Be particular to purchase only those transfer pictures which are covered with a gold leaf on the back, for they will show plainly on any colored surface, while the plain pictures are used only on white or light ground.

COMPOSITION ORNAMENTS FOR PICTURE FRAMES, &C.—Mix as much whiting as you think will be required for present use, with thinish glue, to the consistence of putty; and having a mould ready, rub it well all over with sweet oil, and press your composition in it; take it out and you have a good impression, which you may set by to dry; or, if wanted, you may, before it gets hard, apply it to your work with thick glue, and bend it into the form required.

DRILL LUBRICATOR.—For wrought iron use 1 lb. soft soap mixed with 1 gal. boiling water. It insures good work and clean cutting.

CEMENT FOR EMERY ON WOOD.—Melt together equal parts of shellac, white rosin, and carbolic acid in crystals; add the last after the others are melted. An unrivalled cement.

WEIGHT OF EARTH, ROCKS, &C.—A cubic yard of sand or ground weighs about 30 cwt.; mud, 25 cwt.; marl, 26 cwt.; clay, 31 cwt.; chalk, 36 cwt.; sandstone, 39 cwt.; shale, 40 cwt.; quartz, 41 cwt.; granite 42 cwt.; trap, 42 cwt.; slate, 43 cwt.

TO DETERMINE WEIGHT OF LIVE CATTLE.—Measure in inches the girth round the beast, just behind the shoulder blade, and the length of the back from the tail to the fore part of the shoulder-blade. Multiply the girth by the length, and divide by 144. If the girth is less than 3 feet, multiply the quotient by 11. If between 3 and 5 feet, multiply by 16. If between 5 and 7 feet multiply by 23. If between 7 and 9 feet multiply by 31. If the animal is lean, deduct $\frac{1}{2}$ from the result, or take the girth and length in feet, multiply the square of the girth by the length, and multiply the product by

336. The result will be the answer in pounds. The live weight, multiplied by 6.05, gives a near approximation to the net weight.

TO REPAIR THE SILVERING OF MIRRORS.—Pour upon a sheet of tin foil 3 drs. of quicksilver to the square foot of foil. Rub smartly with a piece of buckskin until the foil becomes brilliant. Lay the glass upon a flat table, face downwards, place the foil upon the damaged portion of the glass, lay a sheet of paper over the foil, and place upon it a block of wood or a piece of marble with a perfectly flat surface; put upon it sufficient weight to press it down tight; let it remain in this position a few hours. The foil will adhere to the glass.

PENCILS FOR WRITING ON GLASS.—Stearic acid 4 pts., Mutton-suet, 3 pts., wax 2 pts.; melt together and add 6 parts of red lead, and 1 pt. purified carbonate of potassa, previously triturated together; set aside for an hour in a warm situation, stirring frequently; then pour into glass tubes or hollow reeds.

MODELLING CLAY.—Knead dry clay with glycerine instead of water, and a mass is obtained which remains moist and plastic for a considerable length of time, being a great convenience for the modeller.

ASPHALT FOR WALKS.—Take 2 pts., very dry lime rubbish, and 1 pt. coal ashes, also very dry, all sifted fine. In a dry place, on a dry day, mix them, and leave a hole in the middle of the heap, as bricklayers do when making mortar. Into this pour boiling hot coal tar; mix, and when as stiff as mortar, put it three inches thick where the walk is to be; the ground should be dry and beaten smooth; sprinkle over it coarse sand. When cold, pass a light roller over it; in a few days the walk will be solid and water-proof.

POLISHING POWDER FOR SPECULA.—Precipitate a dilute solution of sulphate of iron by ammonia in excess; wash the precipitate; press it in a screw press till nearly dry; then expose it to heat until it appears of a dull red color in the dark.

FACTS FOR GAS COMPANIES AND GAS CONSUMERS.—*Purifiers*—Dry purifiers require 1 bushel of lime to 10,000 cubic feet of gas, and 1 superficial foot for every 400 cubic feet of gas. *Wet purifiers* require 1 bushel of lime mixed with 48 bushels of water for every 10,000 cubic feet of gas. *Retorts*—A retort produces about 600 cubic feet of gas in 5 hours with a charge of about $\frac{1}{2}$ cwt. of coal, or 2800 feet in 24 hours; 1 ton of Wigan Cannel has produced coke, 1326 lbs.; tar, 250 lbs.; gas, 338 lbs.; loss, 326 lbs. Pictou and Sidney coal has produced 8000 cubic feet per ton; 1 lb. peat will supply gas for 1 hour's light. Exposed lights require about 5 cubic feet; internal lights require 4 cubic ft. per hour. Large burners require from 6 to 10 cubic feet per hour. A cubic foot of gas, from a jet $\frac{1}{32}$ rd of an inch in diameter and height of flame 4 inches, will burn for 65 minutes. *Rosin Gas*—Jet $\frac{1}{32}$, flame 5 inches, 14 cubic feet per hour. In winter the average duration of internal lights per day is 5.08 hours; in summer it is 2.83, in spring it is 3.41; and in the fall 4.16. Street lamps in New York city consume 3 cubic feet of gas per hour. In some cities 4 and 5 cubic feet are consumed. Fish-tail burners for ordinary coal gas consume 4 to 5 cubic feet of gas per hour. *The standard of gas burn-*

ing is a 15 hole Argand lamp, internal diameter .44 inch, chimney 7 inches in height, consumption 5 cubic feet per hour, giving a light from ordinary coal gas off from 10 to 12 candles, with Cannel coal from 20 to 24 candles, and with the coals of Pennsylvania and Virginia of from 14 to 16 candles. *Loss of Light by Glass Globes*—Clear glass 12 per cent., half ground 35 per cent., full ground 40 per cent. The pressure with which gas is forced through pipes should seldom exceed $2\frac{1}{2}$ inches at the works, or the leakage will exceed the advantages to be obtained from increased pressure. When pipes are laid at an inclination either above or below the horizon, a correction will have to be made in estimating the supply, by adding or deducting $\frac{1}{10}$ of an inch from the initial pressure for every foot of rise or fall in the length of the pipe. By experiment, 30,000 cubic feet of gas, sp. gr. .42 were discharged in an hour through a main 6 inches in diameter and 22.5 feet in length, and 852 cubic feet, specific gravity .398 were discharged under a head of 3 ins. of water, through a main 4 ins. in diam. and 6 miles in length. Loss of volume, if discharged by friction, in a pipe 6 in. diam. and 1 mile in length is estimated at 95 per cent. In distilling 56 lbs. of coal the volume of gas produced in cubic feet when the distillation was effected in 3 hours was 41.3, in 7 hours 27.5, in 20 hours 33.5, and in 25 hours 31.7. The time of explosion is about the 27th part of a second, and the resultant temperature 2474°. *Gas Engines*—In the Lenoir engines, the best proportions of gas and air are, for common gas, 8 volumes of air to 1 of gas, and for canal gas 11 of air to 1 of gas. An engine having a cylinder of $4\frac{1}{2}$ inches diameter, and $8\frac{1}{2}$ inch stroke of piston, making 185 revolutions per minute, develops a power of half a horse.

TO REMOVE DEPOSIT OF CARBON FROM CLAY RETORTS.—Leave the retort unchanged for 48 hours, or as long as can be spared. Put the lid on the mouth-piece so as to be closed at top, and open 2 or three inches at the bottom. Take out the stopper from stand pipe, so as to allow a current of air to pass through the retort and oxydize the carbon; use no bar. Put in a charge of coal after the retort has lain idle the number of hours required, and when it is withdrawn the carbon comes with it.

TO MEND IRON RETORTS.—Fire clay 15 lbs., saleratus, 1 lb. with water sufficient to make a thick paste. Apply to the broken part of the retort while at a good working heat, then cover it with a fine coal dust, and charge the retort for working.

TO STOP LEAKS IN CLAY RETORTS WHEN AT WORKING HEAT.—Five parts fire clay, 2 parts white sand, 1 part of borax pressed and ground. Mix the whole together with as much water as may be necessary to bring it to the consistence of putty. Roll it in the hands to a proper length and apply it over the crack, pressing it with a long spatula into the crack.

TO PREVENT GAS METERS FROM FREEZING.—Half a pint of good glycerine is said to prevent the freezing of 1 gal. water, though at least double the proportion is preferable in the country, whatever the temperature in the winter may happen to be.

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MAGNETIZED WATCH WORKS.—The only cure is to put in a gold or brass balance and new pendulum spring. The most intense heat will not eradicate the trouble.

CEMENT FOR LEATHER.—Bisulphide of carbon, 5 oz.; tick gutta percha, 1 oz. The latter is like thin curly shavings of leather and must be added a little at a time. Cork up tight, and it is fit for using in 10 or 12 hours.

TO REPAIR LEAKAGES IN FIRE ENGINE HOSE.—Pass a round bar of iron into the hose under the leak, then rivet on a patch of leather, previously coated with marine glue.

AQUARIA CEMENT.—Mix equal quantities of dry white lead and red lead to a paste with mastic varnish, and use as soon as mixed.

NEW STEAM PACKING.—Take long coils or continuous strands of flax or hemp loosely twisted, or better still, with scarcely any twist, saturate these coils in melted grease or tallow, and give them a good thorough coating with as much black lead or plumbago (finely pulverized), as the material will absorb. It is a most superior article.

PAPER FRICTION PULLEYS.—These superior mechanical contrivances are made by cutting pieces of pasteboard into a circular form, and of the desired diameter of the pulley, and placing them in layers one on the top of another, cementing properly with a good coat of glue between each layer, pounding or pressing them together as close as possible, and leaving a perforation in the centre of each, for the shaft. When you have got enough of these layers together to give you the proper breadth of pulley, allow the glue to harden, then turn it off to a smooth finish in a lathe. Secure each side of the pulley with a good stout iron flange large enough to cover the entire diameter, or nearly so, and with proper usage it will last a long time.

QUANTITY AND COST OF SUPPLIES FOR HORSES AND LUMBERING CREWS IN THE WOODS.—The following figures have been kindly furnished for this work by the obliging manager of Messrs. Gilmour's mill on the Gatineau, near Ottawa, Canada, and are most valuable as affording a basis for calculating the quantity and quality of the supplies required for men and horses engaged in this branch of industry. These calculations are the result of long experience in the business, and are based on actual consumption.

Quantity of Oats for each span of horses, 51 lbs per day.

	Hay		40	
"	Flour used by each man		1.80	"
"	Pork	" "	1.22	"
"	Beef	" "	0.85	"
"	Beans	" "	0.33	"
"	Fish	" "	0.12	"
"	Onions	" "	0.13	"
"	Potatoes	" "	0.47	"

Total daily consumption per man 4.92

Quantity of Tea used " 1½ lbs. per month.

The daily allowance of oats for each span of horses may appear large, but it must be remembered that the labour is extremely

severe, and more hay will be required if any part of the oats is withheld. On making enquiry with reference to the item of molasses, so largely used by our lumbering friends in New Brunswick and Maine, the answer returned was that owing to the heavy cost of the commodity, it was entirely omitted from the list of supplies. The following exhibits the comparative value of Mess and Prime Mess Pork, calculated from actual consumption:—

Mess Pork.	Prime Mess.	Mess Pork.	Prime Mess.
\$26.....	\$18 80	\$17.....	\$12 24
25.....	18 08	16.....	11 51
24.....	17 35	15.....	10 78
23.....	16 62	14.....	10 05
22.....	15 89	13.....	9 32
21.....	15 16	12.....	8 59
20.....	14 43	11.....	7 86
19.....	13 70	10.....	7 13
18.....	12 97	9.....	6 40

1 Barrel Mess averages 37 lbs. grease, 6lbs bones, when cooked
1 " Prime Mess 22 " 13 " "

TOUGH TYPE METAL.—Lead 100 parts, antimony 32 parts, tin 9.

TO REPAIR CRACKED BELLS.—The discordant tones of a cracked bell being due to the jarring of the rugged uneven edges of the crack against each other, the best remedy that can be applied is to cut a thin slit with a toothless saw driven at a very high velocity, say 3 or 4,000 revolutions per minute, in such a manner as to cut away the opposing edges of the fracture wherever they come in contact. This will restore the original tone of the bell.

TO SEPARATE TIN FROM LEAD.—If the lead and tin are in solution precipitate the former by sulphuric acid and the latter with sulphuretted hydrogen gas. In an alloy the lead will dissolve in nitric acid, leaving the tin as an oxide.

ORNAMENTAL DESIGNS ON SILVER.—Select a smooth part of the silver, and sketch on it a monogram or any other design you choose, with a hard lead pencil, then place the article in a gold solution with the battery in good working order, and in a short time all the parts not sketched with the lead pencil will be covered with a coat of gold. After cleansing the article, the black lead is easily removed by the fingers, and the silver ornament disclosed. A gold ornament may be produced by reversing the process.

FUSIBLE METAL FOR CASTS.—Bismuth, 8 parts, lead, 5 parts, tin 3 parts. It will melt at 200°, or under boiling water. For male casts use tin only.

PRINTER'S INK.—Linseed oil boiled to a thick varnish, and a sufficient quantity of vermilion or Prussian blue ground with it to give the required depth of color.

TO REPAIR LEAKS IN LEAD PIPES.—Place the point of a dull nail over the leak, give it a gentle tap with a hammer and the flow of water will cease.

TO IMPROVE PRINTER'S ROLLERS.—The French composition prevents damp rollers and otherwise improves them. It is made as follows: for a 24 inch roller take Russian isinglass $\frac{1}{4}$ oz.; gelatine $\frac{1}{4}$ oz.; when the usual composition, (see page 106,) is ready for pouring, add the above to it, let all boil $\frac{1}{4}$ hour longer, and cast in the usual way.

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BLASTING POWDER.—Reduce *separately* to powder, 2 parts chlorate of potassa and 1 part red sulphuret of arsenic; mix very lightly together, or; powder separately, 5 parts chlorate of potassa; 2 parts red sulphuret of arsenic, and 1 part ferrocyanide of potassium (prussiate of potassa); mix carefully, or; mix carefully as before, after having separately reduced to powder equal parts chlorate of potassa and ferrocyanide of potassium. These possess eight times the explosive force of gunpowder and must be used with the greatest caution.

ON WOOD CUTS AND NEW WOOD TYPES—Wood cuts should never be washed with lye or water, benzine or camphene only should be used. Large wood letters when new should be soaked in a mixture of turpentine and thin boiled linseed oil over night, and taken out of the bath in the morning and then wiped clean. Let them stand awhile to absorb what oil, etc., may not have been removed by wiping, then ink them well. After they stand a few hours wash them with benzine.

PRINTERS' ROLLERS.—*No. 1. Black Composition*, very durable and elastic. Genuine Irish or Buffalo glue, 10½ lbs., black sugar cane, or best maple molasses, 1 gal., purified India rubber shavings, 1 lb., Carolina tar, 2 ozs., glycerine, 12 ozs., strong vinegar, 4 ozs. Soak the glue over night and drain in the morning by means of a *covered* cullender. Boil molasses and skim for 20 minutes. Add the rubber shavings and stir until it combines with the molasses, add the glue and boil for forty minutes, occasionally stir the mass, add the tar and glycerine boil 6 or 7 minutes, and pour. If purified rubber cannot be procured add 1½ lbs. more glue and 4 oz. more glycerine. *No. 2. for Summer use.* No. 1 glue, 2 lbs.; Baeder's glue, 2 lbs.; best sugar house molasses, 1 gal.; glycerine, ½ pt. For *Winter* use, reduce each glue ¼ to ⅓ of a lb. Soak the glues wrapped up separately in woolen cloths about three hours. Boil the molasses 45 or 50 minutes, skimming thoroughly. Then add the glues drained of superfluous water. Boil the whole for 15 or 20 minutes, add the glycerine, boil and stir 3 to 5 minutes then pour off. *No. 3. Strong Middle Weather Rollers.* Temp. 60° to 70° Fahr. Coopers best glue, 8½ lbs.; extra syrup, 2 gals.; glycerine, 1 pt.; Venice turpentine, 2 oz. Steep the glue in rain water until pliant, and drain it well. Then melt it over a moderate fire, but do not "cook it." This will take from 15 to 25 minutes. Next put in the syrup, and boil ¾ of an hour, stirring it occasionally and skimming off impurities arising to the surface. Add the glycerine and turpentine a few minutes before removing from the fire, and pour slowly. Slightly reduce or increase the glue as the weather becomes colder or warmer.

SILVERING SOLUTION FOR ELECTROTYPE PLATES.—Nitrate of silver 2 drs.; distilled water, 37 drs. Dissolve, and add sal ammoniac, 1 dr.; hydroposphite of soda, 4 drs.; precipitated chalk, 4 drs. Agitate the preparation occasionally for 12 hours when it will be ready for use. Apply with a piece of fine sponge.

LIQUID FOR BRIGHTENING COMMON QUALITIES OF BLACK OR COLORED INKS.—Demar varnish, 1 oz.; balsam fir, ½ oz.; oil bergamot, 25 drops; balsam of copaiba, 35 drops; creosote, 10 drops; copal varnish, 50 drops. Use in small quantities. The whites of

fresh eggs are also brighteners of colored inks, but they must be applied a little at a time, as they dry very hard, and are apt to take away the suction of rollers if used for any extended period.

GOOD REDUCING DRYER.—Brown's (genuine) Japan. Use in small quantities.

HARDENING GLOSS FOR INKS.—Gum Arabic dissolved in alcohol or a weak dilution of oxalic acid. Use in small quantities, and mix with the ink as the latter is consumed.

TO GIVE DARK INKS A BRONZE OR CHANGEABLE HUE.—Dissolve $1\frac{1}{2}$ lbs. gum shellac in 1 gal. 95 per cent alcohol or cologne spirits for 24 hours. Then add 14 ozs. analine red. Let it stand a few hours longer, when it will be ready for use. Add this to good blue, black, or other dark ink, as needed in quantities to suit, when if carefully done they will be found to have a rich bronze or changeable hue.

QUICK DRYER FOR INKS USED ON BOOKBINDERS CASES.—Bee's wax, 1 oz., gum arabic (dissolved in sufficient acetic acid to make a thin mucilage) $\frac{1}{4}$ oz., Brown's Japan, $\frac{1}{4}$ oz. Incorporate with 1 lb. of good Cut ink.

TO RENEW A HARD ROLLER.—Wash the roller carefully with lye, cover the surface with a thin layer of molasses and lay it aside till the next morning, then wash it with water, and let it hang till dry enough for using.

TO TRANSFER PICTURES FROM PAPER TO WOOD FOR RE-ENGRAVING.—Soak the print in a saturated solution of alcohol and white caustic potash to soften the ink, then transfer to the block under roller pressure.

GUM FOR BACKING LABELS.—Mix pure dextrine with boiling water until it assumes the consistency of ordinary mucilage. Apply with a full bodied, evenly made camel's hair brush. The paper should not be too thin or unsized. It will dry quickly and adhere when slightly wet.

PROF. BOTTGER'S PORTABLE INK.—Make the strongest possible solution of analine black in water or alcohol, and soak thick unsized paper thoroughly to imbibe mixture, and then dry.

COLORING AND SIZING OF PAPER.—Paper is adulterated with plaster of Paris, sometimes to the extent of 30 per cent, to increase the weight. Brown paper is mixed with ochre and clay, the manufacturers say to give it a nice brown color, but doubtless, the true reason is, to make it heavier. White soap, glue, starch, and dissolved rosin with a few pounds of alum, form a good size for printing paper to mix with the pulp. Four or five pounds oxide of cobalt (smalts) give a beautiful blue tinge to fine writing paper, when added to 100 lbs. of the rags. Writing paper is sized by being dipped 5 or 6 sheets at a time into a composition made from skins and other animal substances, a large pile of it being afterwards pressed to force out the superfluity, although machines now exist making fine writing paper, sized with gelatine, dried, and cut into sheets, at the rate of 60 feet a minute in length, and 70 inches wide.

OIL FOR FINE MECHANISM.—Oil for fine mechanism can be prepared by putting zinc and lead shavings, in equal parts, into good Florence olive oil, and placing in a cool place until the oil becomes colorless.

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ON MELTING AND REFINING.—In melting *Brass Gold*, urge the fire to a great heat, and stir the metal with the long stem of a tobacco pipe to prevent honey combing. If *Steel or Iron filing* get into gold while melting, throw in a piece of sandiver the size of a common nut; it will attract the iron or steel from the gold into the flux, or, sublimate of mercury will destroy the iron or steel. To cause *Gold to roll well*, melt with a good heat, add a teaspoonful of sal ammoniac and charcoal, equal quantities, both pulverised, stir up well, put on the cover for 2 minutes and pour.

FOR SILVERSMITHS, STERLING SILVER.—1. Fine Silver 11 oz, 2 dwts., fine copper 18 dwts. 2. *Equal to Sterling*—Fine silver 1 oz., fine copper 1 dwt, 12 grs. 3. *Another ditto*—Fine silver 1 oz., fine copper 5 dwts. 4. *Common Silver for Chains*—Fine silver 6 dwts., fine copper 4 dwts. 5. *Solder for ditto*—Fine silver 16 dwts., fine copper 12 grs., pin brass 3 dwts, 12 grs. 6. *Alloy for Plating*—Fine silver 1 oz., fine copper 10 dwts. 7. *Silver Solder*—Fine silver 1 oz., pin brass 10 dwts., pure spelter 2 dwts. 8. *Copper Solder for Plating*—Fine silver 10 cwts., fine copper 10 dwts. 9. *Common Silver Solder*—Fine silver 10 ozs., pin brass 6 ozs. 12 dwts, spelter 12 dwts. 10. *Silver Solder for Enamelling*, \$1 per oz.—Fine silver 14 dwts, fine copper 8 dwts. 11. *Ditto, for filling Signet Rings*—Fine silver 10 ozs., fine copper 1 oz. 16 dwts., fine pin brass 6 ozs 12 dwts., spelter 12 dwts. 12. *Silver Solder for Gold Plating*—Fine silver 1 oz., fine copper 5 dwts., pin brass 5 dwts. 13. *Quick Silver Solder*—Fine silver 1 oz., pin brass 10 dwts., bar tin 2 dwts. 14. *Imitation Silver*—Fine silver 1 oz., nickel 1 oz. 11 grs., fine copper 2 ozs. 9 grs. 15. *Another ditto*—Fine silver 3 ozs., nickel 1 oz. 11 dwts., fine copper 2 ozs. 9 grs., spelter 10 dwts. 16. *Fine Silver Solder for Filigree Work*—Fine silver 4 dwts. 6 grs., pin brass 1 dwt. 17. *Bismuth Solder*—Bismuth 3 ozs. lead 3 ozs. 18 dwts., tin 5 ozs. 6 dwts.

USEFUL ITEMS FOR DAILY REMEMBRANCE.

LEGAL BREVITIES.—A note dated on Sunday is void. A note obtained by fraud, or from one intoxicated, is void. If a note be lost or stolen, it does not release the maker, he must pay it. An endorser of a note is exempt from liability, if not served with notice of its dishonor within 24 hours of its non payment. A note by a minor is void. Notes bear interest only when so stated. Principals are responsible for their agents. Each individual in partnership is responsible for the whole amount of the debts of the firm. Ignorance of the law excuses no one. It is a fraud to conceal a fraud. It is illegal to compound a felony. The law compels no one to do impossibilities. An agreement without a consideration is void. Signatures in lead pencil are good in law. A receipt for money is not legally conclusive. The acts of one partner bind all the others. Contracts made on Sunday cannot be enforced. A contract with a minor is void. A contract made with a lunatic is void. Written contracts concerning land must be under seal.

282 USEFUL ITEMS FOR DAILY REMEMBRANCE.

A TABLE OF DAILY SAVINGS AT COMPOUND INTEREST.

<i>Cents per Day</i>	<i>Per Year</i>	<i>In Ten Years</i>	<i>Fifty Year</i>
2 $\frac{3}{4}$	\$ 10.....	\$ 130.....	\$ 2,900
5 $\frac{1}{4}$	20.....	260.....	5,800
11.....	40.....	520.....	11,600
27 $\frac{1}{2}$	160.....	1,300.....	29,000
55.....	200.....	2,600.....	58,000
1.10.....	400.....	5,200.....	116,000
1.37.....	500.....	6,500.....	145,000

By the above table it appears that if a mechanic, or clerk saves 2 $\frac{3}{4}$ per day from the time he is 21 till he is 70, the total with interest will amount to \$2,900, and a daily saving of 27 $\frac{1}{2}$ cents reaches the important sum of \$29,000. Save all you can in a prudent manner for a time of possible want, but act justly by paying your debts, and liberally by assisting those in need, and helping in a good cause.

ON PROFANE SWEARING—Let every man do his best to discountenance this abominable habit, and shun it as an accursed sin in every possible way. No respectable person will allow himself to be guilty of it. Business men who make a practice of it will find themselves avoided by the best class of customers, for I know that some persons can suffer no mental punishment equal to that inflicted by being compelled to listen to profane language. Besides, every man known as a profane swearer, will not be credited by those whose good opinion is worth having, even when he may be speaking the truth.

ACT WELL YOUR PART, DON'T BE SELFISH.—Remember that it is by imparting happiness to others, and making ourselves useful, that we receive happiness. Stand by this truth, live it out, and always keep doing something useful for the common good, doing it well, and acting sincerely. Endeavour to keep your heart in the attitude of cherishing good will to all, thinking and speaking evil of no one, and always with a kind word for everybody. Selfishness is its own curse; it is a starving vice. The man who does no good gets none. He is like the heath in the desert, neither yielding fruit nor seeing when good cometh, a stunted dwarfish, miserable shrub. Let all your influence be exerted for the purpose of doing all you can for the common good, and individual welfare of every one.

MARRIAGE MAXIMS.—A good wife is the greatest earthly blessing. A wife never makes a greater mistake than when she endeavours to coerce her husband with other weapons than those of love and affection. Those weapons are a sure pull if he has any thing human left in him. Forbear mutual upbraidings. In writing letters, during temporary separation, let nothing contrary to love and sincere affection be expressed, such letters from a wife have a most powerful emotional effect, sometimes little understood by those who writ them. It is the mother who moulds the character and destiny of the child as to the exteriors, therefore let calmness, peace, affection, and firmness rule her conduct towards her children. Children are great imitators, whether they have scolding or peaceful mothers, they are generally sure to learn from the examples set before them, and thus the consequent joy or sorrow is trans-

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<i>Fifty Year</i>	
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ferred to other families, therefore let mothers take heed to their conduct. It is not possible to exercise judgment and prudence too much before entering on the married life. Be sure that the affections on both sides are so perfectly intertwined around each other, that the two as it were, form one mind, this requires time; and a thorough mutual knowledge on both sides. Marry in your own religion, and into a different blood and temperament from your own. Bend your whole powers to avoid depreciatory remarks, jibing and anger in every form, and specially avoid everlastingly dishing up any unsuccessful past action that was done from a good motive and with the best intentions at the time. Let nothing foreign to the spirit of love and mutual affection intervene to cause distance between husband and wife; to this end let self-denial rule over each, and reciprocal unselfishness. Avoid habitual fault-finding, scolding, &c., as you would perdition itself; many men tremble as they cross their threshold into the presence of scolding wives. Let husband and wife cultivate habits of sobriety, and specially avoid drunkenness in every form. What a dreadful spectacle it is to see a husband transformed into a demon, tottering homeward to a broken-hearted wife, whose noble self-sacrificing devotion to him seems to partake more of the nature of heaven than of earth. Never part even on a journey, without kind and endearing words, and as a kiss symbolizes union from interior affection, do not spare it on such occasions, repeating it when you return. In due word, let love rule supreme.

CHILDREN AND HOME CONVERSATION.—Children hunger perpetually for new ideas. They will learn with pleasure from the lips of parents what they deem drudgery to learn from books, and even if they have the misfortune to be deprived of many educational advantages they will grow up intelligent if they enjoy in childhood the privilege of listening to the conversation of intelligent people. Let them have many opportunities of learning in this way. Be kind to them, and don't think it beneath you to answer their little questions, for they proceed from an implanted faculty which every true man and woman should take a great delight in gratifying.

HOME AFTER BUSINESS HOURS.—Happy is the man who can find that solace and that poetry at home. Warm greetings from loving hearts, fond glances from bright eyes, and welcome shouts of merry hearted children, the many thousand little arrangements for comfort and enjoyment, that silently tell of thoughtful and expectant love, these are the ministrations that reconcile us to the prose of life. Think of this ye wives and daughters of business men! Think of the toils, the anxieties, the mortification and wear that fathers undergo to secure for you comfortable homes, and compensate them for their toils by making them happy by their own fire side.

WELL WORTHY OF IMITATION.—A worthy Quaker thus wrote:—"I expect to pass through this world but once. If therefore, there be any kindness I can do to any fellow being, let me do it now, let me not defer nor neglect it, for I will not pass this way again."

Were all to act thus how many would be made happy!

ANOTHER SENSIBLE QUAKER.—A Quaker lately propounded the momentous question to a fair Quakeress, as follows: "Hun! yea

and verily ; Penelope, she spake urgent and moveth me wonderfully to beseech thee to cleave unto me, flesh of my flesh, and bone of my bone." "Hush! truly, Obadiah, thou hast wisely said. Inasmuch as it is not good for man to be alone, lo, I will sojourn with thee."

TABLE CONVERSATION.—Instead of swallowing your food in sullen silence, or brooding over your business, or severely talking about others, let the conversation at the table be genial, kind, social and cheering. Don't bring any disagreeable subjects to the table in your conversation, any more than you would in your dishes. Avoid scandalizing people, and never cherish a jubilant feeling over the infirmities or misfortunes of others. The more good company you have at your table the better. Hence the intelligence, refinement and appropriate behaviour of a family given to hospitality. Never feel that intelligent visitors can be anything but a blessing to you and yours.

KEEP THE HOUSE CLEAN AND WELL VENTILATED.—A neat, clean, fresh aired, sweet, cheerful, well arranged house, exerts a moral influence over its inmates, and makes the members of a family peaceable and considerate of each other's feelings ; on the contrary, a filthy, squalid, noxious dwelling, contributes to make its inhabitants selfish, sensual, and regardless of the feelings of others. Never sleep in a small close bedroom, either during summer or winter without free ventilation from door or windows, unless otherwise supplied with abundance of fresh air. It will be seen that a person's house usually corresponds to his character.

SAFE BUSINESS RULES.—**BUSINESS MEN**, in business hours, attend only to business matters. **SOCIAL CALLS** are best adapted to the **SOCIAL CIRCLE**. Make your business known in few words, without loss of time. Let your dealings with a stranger be most carefully considered, and tried friendship duly appreciated. A mean act will soon recoil, and a man of honour will be esteemed. Leave "TRICKS OF TRADE" to those whose education was never completed. Treat all with respect, confide in few, wrong no man. Be never afraid to say No, and always prompt to acknowledge and rectify a wrong. Leave nothing for to-morrow that should be done to-day. Because a friend is polite, do not think his time is valueless. Have a place for every thing, and every thing in its place. To preserve long friendship, keep a short credit, the way to get credit is to be punctual ; the way to preserve it is not to use it much. Settle often ; have short accounts. Trust no man's appearances, they are often deceptive, and assumed for the purpose of obtaining credit. Rogues generally dress well. The rich are generally plain men. Be well satisfied before you give a credit, that those to whom you give it are safe men to be trusted.

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INTEREST TABLE,

AT SIX PER CENT., IN DOLLARS AND CENTS FROM ONE DOLLAR TO
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	1 day.	7 days.	15 days.	1 mo.	3 mos.	6 mos.	12 mos.
\$	\$ c.	\$ c.	\$ c.	\$ c.	\$ c.	\$ c.	\$ c.
1	00	00	00	00	01	03	03
2	00	00	00	01	03	06	12
3	00	00	00	01	04	09	18
4	00	00	01	02	06	12	24
5	00	00	01	02	07	15	31
6	00	00	01	03	09	18	36
7	00	00	01	03	10	21	42
8	00	01	02	04	12	24	48
9	00	01	02	04	13	27	54
10	00	01	02	05	15	30	60
20	00	02	05	10	30	60	1 20
30	00	03	07	15	45	90	1 80
40	00	04	10	20	60	1 20	2 40
50	01	06	12	25	75	1 50	3 00
100	01	11	25	50	1 50	3 00	6 00
200	03	23	50	1 00	3 00	6 00	12 00
300	05	35	75	1 50	4 50	9 00	18 00
400	07	46	1 00	2 00	6 00	12 00	24 00
500	08	58	1 25	2 50	7 50	15 00	30 00
1000	17	1 16	2 50	5 00	15 00	30 00	60 00
2000	33	2 33	5 00	10 00	30 00	60 00	120 00
3000	50	3 50	7 50	15 00	45 00	90 00	180 00
4000	67	4 66	10 00	20 00	60 00	120 00	240 00
5000	83	5 83	12 50	25 00	75 00	150 00	300 00
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AT SEVEN PER CENT., IN DOLLARS AND CENTS, FROM ONE DOLLAR
TO TEN THOUSAND.

1	00	00	00	00	01	03	07
2	00	00	00	01	03	07	14
3	00	00	00	01	05	10	21
4	00	00	01	02	07	14	28
5	00	00	01	03	08	17	35
6	00	00	01	03	09	21	42
7	00	01	02	04	12	24	49
8	00	01	02	04	14	28	56
9	00	01	02	05	15	31	63
10	00	01	03	05	17	35	70
20	00	02	06	11	35	70	1 40
30	00	04	09	17	52	1 05	2 10
40	00	05	12	23	70	1 40	2 80
50	01	06	15	29	87	1 75	3 50
100	02	13	29	58	1 75	3 50	7 00
200	04	27	58	1 16	3 50	7 00	14 00
300	06	40	87	1 75	5 25	10 50	21 00
400	08	54	1 17	2 33	7 00	14 00	28 00
500	10	68	1 46	2 91	8 75	17 50	35 00
1000	19	1 86	2 92	5 83	17 50	35 00	70 00
2000	39	2 72	5 83	11 66	35 00	70 00	140 00
3000	58	4 08	8 75	17 50	52 50	105 00	210 00
4000	78	5 44	11 67	23 33	70 00	140 00	280 00
5000	97	6 80	14 58	29 16	87 50	175 00	350 00
10000	1 94	13 61	29 17	58 33	175 00	350 00	700 00

READY RECKONER, 2,000 LBS. TO THE TON.

**PRODUCE AND MERCHANDISE READY RECKONERS HAY, BUTTER,
CHEESE, LARD AND OTHER PRODUCE.**

READY RECKONER, to find the Price of any Number of Pounds, at the Rate of 2,000 Pounds to the Ton.

[illegible]

<i>Lbs</i>	<i>\$ cts</i> 13.90	<i>\$ cts</i> 14.00	<i>\$ cts</i> 15.00	<i>\$ cts</i> 16 00	<i>\$ cts</i> 17.00	<i>\$ cts</i> 19.00	<i>\$ cts</i> 20.00	<i>\$ cts</i> 25.00	<i>\$ cts</i> 40.00	<i>\$ cts</i> 50.00
3	.2	.2	.2	.2	.3	.3	.3	.4	.6	.8
7	.5	.5	.5	.6	.6	.7	.7	.9	.14	.18
10	.7	.7	.8	.8	.9	.10	.10	.13	.20	.25
20	.13	.14	.15	.16	.17	.19	.20	.25	.40	.50
30	.20	.21	.23	.24	.26	.29	.30	.38	.60	.75
50	.33	.35	.38	.40	.43	.48	.50	.63	1.00	1.25
70	.46	.49	.53	.56	.60	.67	.70	.88	1.40	1.75
80	.52	.56	.60	.64	.68	.76	.80	1.00	1.60	2.00
90	.59	.63	.68	.72	.77	.86	.90	1.13	1.80	2.25
100	.65	.70	.75	.80	.85	.95	1.00	1.25	2.00	2.50
200	1.30	1.40	1.50	1.60	1.70	1.90	2.00	2.50	4.00	5.00
300	1.95	2.10	2.25	2.40	2.55	2.85	3.00	3.75	6.00	7.50
400	2.60	2.80	3.00	3.20	3.40	3.80	4.00	5.00	8.00	10.00
500	3.25	3.50	3.75	4.00	4.25	4.75	5.00	6.25	10.00	12.50
600	3.90	4.20	4.50	4.80	5.10	5.70	6.00	7.50	12.00	15.00
700	4.55	4.90	5.25	5.60	5.95	6.65	7.00	8.75	14.00	17.50
800	5.20	5.60	6.00	6.40	6.80	7.60	8.00	10.00	16.00	20.00
900	5.85	6.30	6.75	7.20	7.65	8.55	9.00	11.25	18.00	22.50
1000	6.50	7.00	7.50	8.00	8.50	9.50	10.00	12.50	20.00	25.00
1100	7.15	7.70	8.25	8.80	9.35	10.45	11.00	13.75	22.00	27.50
1200	7.80	8.40	9.00	9.60	10.20	11.40	12.00	15.00	24.00	30.00
1300	8.45	9.10	9.75	10.40	11.05	12.35	13.00	16.25	26.00	32.50
1400	9.10	9.80	10.50	11.20	11.95	13.30	14.00	17.50	28.00	35.00
1500	9.75	10.50	11.25	12.00	12.75	14.25	15.00	18.75	30.00	37.50
1600	10.40	11.20	12.00	12.80	13.60	15.20	16.00	20.00	32.00	40.00
1700	11.05	11.90	12.75	13.60	14.45	16.15	17.00	21.25	34.00	42.50
1800	11.70	12.60	13.50	14.40	15.30	17.10	18.00	22.50	36.00	45.00
1900	12.35	13.30	14.25	15.20	16.15	18.05	19.00	23.75	38.00	47.50

READY RECKONER to find the Price of

AY, BUTTER.

If the No. required is not in the tables, add the amounts of two numbers together

8 cts	9 cts	10 cts
10.00	11.00	12.00

READY RECKONER, to find the Price of any Number of Pounds, at the Rate of 2,240 Pounds to the Ton.

Lbs	cts	cts	cts	cts	cts	cts	cts	cts	cts	cts	cts	cts	cts	cts
25	.50	1.00	2.00	3.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00		
20	..	..	..	2	3	4	5	6	7	8	9	10	11	12
25	..	..	1	2	3	4	5	6	7	8	9	10	11	12
30	..	..	1	3	4	5	6	7	8	9	10	11	12	13
35	..	..	1	2	4	5	6	7	8	9	10	11	12	13
40	..	1	2	4	5	6	7	8	9	10	11	12	13	14
50	..	2	3	6	9	11	13	16	18	20	22	25	27	30
60	..	2	4	7	11	18	21	25	29	32	36	39	43	48
70	..	2	4	8	12	20	24	28	32	36	40	44	48	53
80	..	2	4	9	13	22	27	31	36	40	45	49	53	58
90	..	2	4	9	13	22	27	31	36	40	45	49	53	58
100	1	2	4	9	13	22	27	31	36	40	45	49	53	58
200	2	4	9	18	27	45	54	63	71	80	89	98	107	116
300	3	7	13	27	40	67	80	94	107	121	134	147	161	174
400	4	9	18	36	54	89	107	125	143	161	179	196	214	232
500	6	11	22	45	67	112	134	156	179	201	223	246	268	290
600	7	13	27	54	80	134	161	188	214	241	268	295	321	347
700	8	16	31	63	94	156	187	219	250	281	312	344	375	406
800	9	18	36	71	107	179	214	250	286	321	357	393	429	465
900	10	20	40	80	121	201	241	281	321	362	402	442	482	522
1000	11	22	45	89	134	223	268	313	357	402	446	491	536	581
1100	12	25	49	98	147	240	295	344	393	442	491	540	589	638
1200	13	27	54	107	161	268	321	375	429	482	536	589	643	696
1300	14	29	58	116	174	290	348	406	464	522	580	638	696	754
1400	16	31	62	125	187	312	375	438	500	562	625	687	750	812
1500	17	33	67	134	201	335	402	469	536	603	670	737	804	871
1600	18	36	71	143	214	357	428	500	571	643	714	786	857	928
1700	19	38	76	152	228	379	456	531	607	688	759	835	911	987
1800	20	40	80	161	241	402	482	563	643	723	804	884	964	1044
1900	21	42	85	170	254	424	509	594	678	763	848	933	1018	1103
2000	22	45	89	178	268	446	536	625	714	803	893	982	1071	1160
2100	22	47	94	187	281	469	562	656	750	844	937	1031	1125	1219

Lbs	cts	cts	cts	cts	cts	cts	cts	cts	cts	cts	cts	cts	cts	cts
13.00	14.00	15.00	16.00	17.00	18.00	19.00	20.00	21.00	22.00	23.00	24.00			
20	.12	.13	.13	.14	.15	.17	.18	.19	.21	.21	.21	.21	.21	.21
25	.15	.16	.17	.18	.19	.21	.22	.23	.23	.23	.23	.23	.23	.23
30	.17	.19	.20	.21	.23	.25	.27	.28	.28	.28	.28	.28	.28	.28
35	.19	.21	.23	.26	.28	.32	.35	.37	.37	.37	.37	.37	.37	.37
40	.21	.24	.27	.30	.33	.38	.42	.45	.47	.47	.47	.47	.47	.47
50	.29	.31	.33	.36	.38	.45	.49	.52	.56	.56	.56	.56	.56	.56
60	.38	.40	.42	.45	.47	.56	.61	.65	.71	.71	.71	.71	.71	.71
70	.46	.50	.54	.57	.61	.68	.76	.80	.84	.84	.84	.84	.84	.84
80	.52	.56	.60	.64	.68	.76	.84	.88	.92	.92	.92	.92	.92	.92
90	.56	.63	.67	.71	.76	.85	.94	.99	1.03	1.03	1.03	1.03	1.03	1.03
100	1.16	1.25	1.34	1.42	1.52	1.70	1.79	1.88	2.05	2.05	2.05	2.05	2.05	2.05
200	1.74	1.88	2.01	2.14	2.28	2.54	2.68	2.81	3.08	3.08	3.08	3.08	3.08	3.08
300	2.32	2.60	2.86	2.86	3.04	3.39	3.57	3.75	4.11	4.11	4.11	4.11	4.11	4.11
400	2.90	3.13	3.36	3.57	3.79	4.24	4.46	4.69	5.13	5.13	5.13	5.13	5.13	5.13
500	3.48	3.75	4.02	4.29	4.55	5.09	5.36	5.63	6.16	6.16	6.16	6.16	6.16	6.16
600	4.06	4.38	4.69	5.00	5.31	5.94	6.25	6.56	7.19	7.19	7.19	7.19	7.19	7.19
700	4.64	5.00	5.36	5.71	6.07	6.79	7.14	7.50	8.21	8.21	8.21	8.21	8.21	8.21
800	5.22	5.63	6.03	6.43	6.83	7.63	8.04	8.44	9.24	9.24	9.24	9.24	9.24	9.24
900	5.80	6.25	6.70	7.14	7.59	8.48	8.93	9.38	10.27	10.27	10.27	10.27	10.27	10.27
1000	6.38	6.88	7.37	7.86	8.35	9.33	9.82	10.31	11.29	11.29	11.29	11.29	11.29	11.29
1100	6.96	7.50	8.04	8.57	9.11	10.18	10.71	11.25	12.32	12.32	12.32	12.32	12.32	12.32
1200	7.54	8.13	8.70	9.28	9.87	11.03	11.61	12.19	13.35	13.35	13.35	13.35	13.35	13.35
1300	8.12	8.75	9.37	10.00	10.62	11.87	12.50	13.13	14.37	14.37	14.37	14.37	14.37	14.37
1400	8.70	9.38	10.04	10.71	11.38	12.72	13.39	14.06	15.40	15.40	15.40	15.40	15.40	15.40
1500	9.28	10.00	10.71	11.43	12.14	13.57	14.28	15.00	16.43	16.43	16.43	16.43	16.43	16.43
1600	9.86	10.63	11.38	12.14	12.90	14.42	15.18	15.94	17.45	17.45	17.45	17.45	17.45	17.45
1700	10.44	11.25	12.05	12.86	13.66	15.27	16.07	16.88	18.48	18.48	18.48	18.48	18.48	18.48
1800	11.03	11.88	12.72	13.57	14.42	16.12	16.96	17.81	19.51	19.51	19.51	19.51	19.51	19.51
1900	11.61	12.50	13.39	14.28	15.18	16.96	17.76	18.75	20.53	20.53	20.53	20.53	20.53	20.53
2000	12.19	13.12	14.06	15.00	15.94	17.81	18.75	19.69	21.56	21.56	21.56	21.56	21.56	21.56

READY RECKONER, 2,240 LBS. TO THE TON.
If the article cost \$12.50 per ton, add the amounts under \$12.00 and 50 cts. together.

Lbs.	\$ cts		\$ cts		\$ cts		\$ cts		\$ cts		\$ cts		\$ cts		\$ cts		\$ cts	
	25 00	26 00	27 00	28 00	29 00	30 00	31 00	32 00	33 00	34 00	35 00	36 00	37 00	38 00	39 00	40 00	41 00	42 00
20	.22	.23	.24	.25	.26	.27	.28	.29	.30	.31	.32	.33	.34	.35	.36	.37	.38	.39
25	.28	.29	.30	.31	.32	.33	.34	.35	.36	.37	.38	.39	.40	.41	.42	.43	.44	.45
30	.33	.35	.36	.37	.38	.39	.40	.41	.42	.43	.44	.45	.46	.47	.48	.49	.50	.51
35	.38	.39	.40	.41	.42	.43	.44	.45	.46	.47	.48	.49	.50	.51	.52	.53	.54	.55
40	.43	.45	.46	.47	.48	.49	.50	.51	.52	.53	.54	.55	.56	.57	.58	.59	.60	.61
45	.48	.49	.50	.51	.52	.53	.54	.55	.56	.57	.58	.59	.60	.61	.62	.63	.64	.65
50	.53	.55	.56	.57	.58	.59	.60	.61	.62	.63	.64	.65	.66	.67	.68	.69	.70	.71
55	.58	.59	.60	.61	.62	.63	.64	.65	.66	.67	.68	.69	.70	.71	.72	.73	.74	.75
60	.63	.65	.66	.67	.68	.69	.70	.71	.72	.73	.74	.75	.76	.77	.78	.79	.80	.81
65	.68	.69	.70	.71	.72	.73	.74	.75	.76	.77	.78	.79	.80	.81	.82	.83	.84	.85
70	.73	.75	.76	.77	.78	.79	.80	.81	.82	.83	.84	.85	.86	.87	.88	.89	.90	.91
75	.78	.79	.80	.81	.82	.83	.84	.85	.86	.87	.88	.89	.90	.91	.92	.93	.94	.95
80	.83	.85	.86	.87	.88	.89	.90	.91	.92	.93	.94	.95	.96	.97	.98	.99	1.00	1.01
85	.88	.89	.90	.91	.92	.93	.94	.95	.96	.97	.98	.99	1.00	1.01	1.02	1.03	1.04	1.05
90	.93	.95	.96	.97	.98	.99	1.00	1.01	1.02	1.03	1.04	1.05	1.06	1.07	1.08	1.09	1.10	1.11
95	.98	.99	1.00	1.01	1.02	1.03	1.04	1.05	1.06	1.07	1.08	1.09	1.10	1.11	1.12	1.13	1.14	1.15
100	1.03	1.05	1.06	1.07	1.08	1.09	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.18	1.19	1.20	1.21
105	1.08	1.09	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.18	1.19	1.20	1.21	1.22	1.23	1.24	1.25
110	1.13	1.15	1.16	1.17	1.18	1.19	1.20	1.21	1.22	1.23	1.24	1.25	1.26	1.27	1.28	1.29	1.30	1.31
115	1.18	1.19	1.20	1.21	1.22	1.23	1.24	1.25	1.26	1.27	1.28	1.29	1.30	1.31	1.32	1.33	1.34	1.35
120	1.23	1.25	1.26	1.27	1.28	1.29	1.30	1.31	1.32	1.33	1.34	1.35	1.36	1.37	1.38	1.39	1.40	1.41
125	1.28	1.29	1.30	1.31	1.32	1.33	1.34	1.35	1.36	1.37	1.38	1.39	1.40	1.41	1.42	1.43	1.44	1.45
130	1.33	1.35	1.36	1.37	1.38	1.39	1.40	1.41	1.42	1.43	1.44	1.45	1.46	1.47	1.48	1.49	1.50	1.51
135	1.38	1.39	1.40	1.41	1.42	1.43	1.44	1.45	1.46	1.47	1.48	1.49	1.50	1.51	1.52	1.53	1.54	1.55
140	1.43	1.45	1.46	1.47	1.48	1.49	1.50	1.51	1.52	1.53	1.54	1.55	1.56	1.57	1.58	1.59	1.60	1.61
145	1.48	1.49	1.50	1.51	1.52	1.53	1.54	1.55	1.56	1.57	1.58	1.59	1.60	1.61	1.62	1.63	1.64	1.65
150	1.53	1.55	1.56	1.57	1.58	1.59	1.60	1.61	1.62	1.63	1.64	1.65	1.66	1.67	1.68	1.69	1.70	1.71
155	1.58	1.59	1.60	1.61	1.62	1.63	1.64	1.65	1.66	1.67	1.68	1.69	1.70	1.71	1.72	1.73	1.74	1.75
160	1.63	1.65	1.66	1.67	1.68	1.69	1.70	1.71	1.72	1.73	1.74	1.75	1.76	1.77	1.78	1.79	1.80	1.81
165	1.68	1.69	1.70	1.71	1.72	1.73	1.74	1.75	1.76	1.77	1.78	1.79	1.80	1.81	1.82	1.83	1.84	1.85
170	1.73	1.75	1.76	1.77	1.78	1.79	1.80	1.81	1.82	1.83	1.84	1.85	1.86	1.87	1.88	1.89	1.90	1.91
175	1.78	1.79	1.80	1.81	1.82	1.83	1.84	1.85	1.86	1.87	1.88	1.89	1.90	1.91	1.92	1.93	1.94	1.95
180	1.83	1.85	1.86	1.87	1.88	1.89	1.90	1.91	1.92	1.93	1.94	1.95	1.96	1.97	1.98	1.99	2.00	2.01
185	1.88	1.89	1.90	1.91	1.92	1.93	1.94	1.95	1.96	1.97	1.98	1.99	2.00	2.01	2.02	2.03	2.04	2.05
190	1.93	1.95	1.96	1.97	1.98	1.99	2.00	2.01	2.02	2.03	2.04	2.05	2.06	2.07	2.08	2.09	2.10	2.11
195	1.98	1.99	2.00	2.01	2.02	2.03	2.04	2.05	2.06	2.07	2.08	2.09	2.10	2.11	2.12	2.13	2.14	2.15
200	2.03	2.05	2.06	2.07	2.08	2.09	2.10	2.11	2.12	2.13	2.14	2.15	2.16	2.17	2.18	2.19	2.20	2.21
205	2.08	2.09	2.10	2.11	2.12	2.13	2.14	2.15	2.16	2.17	2.18	2.19	2.20	2.21	2.22	2.23	2.24	2.25
210	2.13	2.15	2.16	2.17	2.18	2.19	2.20	2.21	2.22	2.23	2.24	2.25	2.26	2.27	2.28	2.29	2.30	2.31
215	2.18	2.19	2.20	2.21	2.22	2.23	2.24	2.25	2.26	2.27	2.28	2.29	2.30	2.31	2.32	2.33	2.34	2.35
220	2.23	2.25	2.26	2.27	2.28	2.29	2.30	2.31	2.32	2.33	2.34	2.35	2.36	2.37	2.38	2.39	2.40	2.41
225	2.28	2.29	2.30	2.31	2.32	2.33	2.34	2.35	2.36	2.37	2.38	2.39	2.40	2.41	2.42	2.43	2.44	2.45
230	2.33	2.35	2.36	2.37	2.38	2.39	2.40	2.41	2.42	2.43	2.44	2.45	2.46	2.47	2.48	2.49	2.50	2.51
235	2.38	2.39	2.40	2.41	2.42	2.43	2.44	2.45	2.46	2.47	2.48	2.49	2.50	2.51	2.52	2.53	2.54	2.55
240	2.43	2.45	2.46	2.47	2.48	2.49	2.50	2.51	2.52	2.53	2.54	2.55	2.56	2.57	2.58	2.59	2.60	2.61
245	2.48	2.49	2.50	2.51	2.52	2.53	2.54	2.55	2.56	2.57	2.58	2.59	2.60	2.61	2.62	2.63	2.64	2.65
250	2.53	2.55	2.56	2.57	2.58	2.59	2.60	2.61	2.62	2.63	2.64	2.65	2.66	2.67	2.68	2.69	2.70	2.71
255	2.58	2.59	2.60	2.61	2.62	2.63	2.64	2.65	2.66	2.67	2.68	2.69	2.70	2.71	2.72	2.73	2.74	2.75
260	2.63	2.65	2.66	2.67	2.68	2.69	2.70	2.71	2.72	2.73	2.74	2.75	2.76	2.77	2.78	2.79	2.80	2.81
265	2.68	2.69	2.70	2.71	2.72	2.73	2.74	2.75	2.76	2.77	2.78	2.79	2.80	2.81	2.82	2.83	2.84	2.85
270	2.73	2.75	2.76	2.77	2.78	2.79	2.80	2.81	2.82	2.83	2.84	2.85	2.86	2.87	2.88	2.89	2.90	2.91
275	2.78	2.79	2.80	2.81	2.82	2.83	2.84	2.85	2.86	2.87	2.88	2.89	2.90	2.91	2.92	2.93	2.94	2.95
280	2.83	2.85	2.86	2.87	2.88	2.89	2.90	2.91	2.92	2.93	2.94	2.95	2.96	2.97	2.98	2.99	3.00	3.01
285	2.88	2.89	2.90	2.91	2.92	2.93	2.94	2.95	2.96	2.97	2.98	2.99	3.00	3.01	3.02	3.03	3.04	3.05
290	2.93	2.95	2.96	2.97	2.98	2.99	3.00	3.01	3.02	3.03	3.04	3.05	3.06	3.07	3.08	3.09	3.10	3.11
295	2.98	2.99	3.00	3.01	3.02	3.03	3.04	3.05	3.06	3.07	3.08	3.09	3.10	3.11	3.12	3.13	3.14	3.15
300	3.03	3.05	3.06	3.07	3.08	3.09	3.10	3.11	3.12	3.13	3.14	3.15	3.16	3.17	3.18	3.19	3.20	3.21
305	3.08	3.09	3.10	3.11	3.12	3.13	3.14	3.15	3.16	3.17	3.18	3.19	3.20	3.21	3.22	3.23	3.24	3.25
310	3.13	3.15	3.16	3.17	3.18	3.19	3.20	3.21	3.22	3.23	3.24	3.25	3.26	3.27	3.28	3.29	3.30	3.31
315	3.18	3.19	3.20	3.21	3.22	3.23	3.24	3.25	3.26	3.27	3.28	3.29	3.30	3.31	3.32	3.33	3.34	3.35
320	3.23	3.25	3.26	3.27	3.28	3.29	3.30	3.31	3.32	3.33	3.34	3.35	3.36	3.37	3.38	3.39	3.40	3.41
325	3.28	3.29	3.30	3.31	3.32	3.33	3.34	3.35	3.36	3.37	3.38	3.39	3.40	3.41	3.42	3.43	3.44	3.45
330	3.33	3.35	3.36	3.37	3.38	3.39	3.40	3.41	3.42	3.43	3.44	3.45	3.46	3.47	3.48	3.49	3.50	3.51
335	3.38	3.39	3.40	3.41	3.42	3.43	3.44	3.45	3.46	3.47	3.48	3.49	3.50	3.51	3.52	3.53	3.54	3.55
340	3.43	3.45	3.46	3.47	3.48	3.49	3.50	3.51	3.52	3.53	3.54	3.55	3.56	3.57	3.58	3.59	3.60	3.61
345	3.48	3.49	3.50	3.51	3.52	3.53	3.54	3.55	3.56	3.57	3.58	3.59	3.60	3.61	3.62	3.63	3.64	3.65
350	3.53	3.55	3.56	3.57	3.58	3.59	3.60	3.61	3.62	3.63	3.64	3.65	3.66	3.67	3.68	3.69	3.70	3.71
355	3.58	3.59	3.60	3.61	3.62	3.63	3.64	3.65	3.66	3.67	3.68	3.69	3.70	3.71	3.72	3.73	3.74	3.75
360	3.63	3.65	3.66	3.67	3.68	3.69	3.70	3.71	3.72	3.73	3.74	3.75	3.76	3.77	3.78	3.79	3.80	3.81
365	3.68	3.69	3.70	3.71	3.72	3.73	3.74	3.75	3.76	3.77	3.78	3.79	3.80	3.81	3.82	3.83	3.84	3.85
370	3.73	3.75	3.76	3.77	3.78	3.79	3.80	3.81										

READY RECKONER.

TON.

12 00 and 50 cts.

READY RECKONER, to find the Price of any Number of Pounds, Yards, Pieces, or Bushels, from 2 cents to \$3.00.

The first column contains the NUMBER, the top columns the PRICES.

12 00 and 50 cts.

12 00	50 cts	50 cts
35 00	35 00	35 00
30	31	32
33	39	40
40	47	48
75	78	80
06	1 09	1 12
21	1 25	1 29
37	1 41	1 45
52	1 56	1 61
04	3 12	3 21
55	4 69	4 82
07	6 25	6 43
59	7 81	8 04
11	9 38	9 64
62	10 94	11 25
13	12 50	12 86
66	14 06	14 46
18	15 63	16 07
70	17 19	17 68
21	18 75	19 29
73	20 31	20 89
25	21 88	22 50
77	23 44	24 11
28	25 00	25 71
80	26 56	27 31
32	28 13	28 93
84	29 69	30 53
36	31 25	32 14
87	32 81	33 75

12 00 and 50 cts.

12 00	50 cts	50 cts
35 00	35 00	35 00
45	49	54
56	61	67
67	74	80
12	1 23	1 34
56	1 72	1 87
79	1 96	2 14
01	2 21	2 41
23	2 46	2 68
46	2 71	2 96
70	2 96	3 24
93	3 21	3 51
16	3 46	3 78
39	3 71	4 04
62	3 96	4 31
85	4 21	4 51
08	4 46	4 78
31	4 71	5 04
54	4 96	5 31
77	5 21	5 54
00	5 46	5 78
23	5 71	6 04
46	5 96	6 31
69	6 21	6 54
92	6 46	6 78
15	6 71	7 04
38	6 96	7 31
61	7 21	7 54
84	7 46	7 78
07	7 71	8 04
30	7 96	8 31
53	8 21	8 54
76	8 46	8 78
99	8 71	9 04
22	8 96	9 31
45	9 21	9 54
68	9 46	9 78
91	9 71	10 04
14	9 96	10 31
37	10 21	10 54
60	10 46	10 78
83	10 71	11 04
06	10 96	11 31
29	11 21	11 54
52	11 46	12 00
75	11 71	12 26
98	11 96	12 52
21	12 21	13 00
44	12 46	13 26
67	12 71	13 52
90	12 96	14 00
13	13 21	14 26
36	13 46	14 52
59	13 71	15 00
82	13 96	15 26
05	14 21	15 52
28	14 46	16 00
51	14 71	16 26
74	14 96	16 52
97	15 21	17 00
20	15 46	17 26
43	15 71	17 52
66	15 96	18 00
89	16 21	18 26
12	16 46	18 52
35	16 71	19 00
58	16 96	19 26
81	17 21	19 52
04	17 46	20 00
27	17 71	20 26
50	17 96	20 52
73	18 21	21 00
96	18 46	21 26
19	18 71	21 52
42	18 96	22 00
65	19 21	22 26
88	19 46	22 52
11	19 71	23 00
34	19 96	23 26
57	20 21	23 52
80	20 46	24 00
03	20 71	24 26
26	20 96	24 52
49	21 21	25 00
72	21 46	25 26
95	21 71	25 52
18	21 96	26 00
41	22 21	26 26
64	22 46	26 52
87	22 71	27 00
10	22 96	27 26
33	23 21	27 52
56	23 46	28 00
79	23 71	28 26
02	23 96	28 52
25	24 21	29 00
48	24 46	29 26
71	24 71	29 52
94	24 96	30 00
17	25 21	30 26
40	25 46	30 52
63	25 71	31 00
86	25 96	31 26
09	26 21	31 52
32	26 46	32 00
55	26 71	32 26
78	26 96	32 52
01	27 21	33 00
24	27 46	33 26
47	27 71	33 52
70	27 96	34 00
93	28 21	34 26
16	28 46	34 52
39	28 71	35 00
62	28 96	35 26
85	29 21	35 52
08	29 46	36 00
31	29 71	36 26
54	29 96	36 52
77	30 21	37 00
00	30 46	37 26
23	30 71	37 52
46	30 96	38 00
69	31 21	38 26
92	31 46	38 52
15	31 71	39 00
38	31 96	39 26
61	32 21	39 52
84	32 46	40 00
07	32 71	40 26
30	32 96	40 52
53	33 21	41 00
76	33 46	41 26
99	33 71	41 52
22	33 96	42 00
45	34 21	42 26
68	34 46	42 52
91	34 71	43 00
14	34 96	43 26
37	35 21	43 52
60	35 46	44 00
83	35 71	44 26
06	35 96	44 52
29	36 21	45 00
52	36 46	45 26
75	36 71	45 52
98	36 96	46 00
21	37 21	46 26
44	37 46	46 52
67	37 71	47 00
90	37 96	47 26
13	38 21	47 52
36	38 46	48 00
59	38 71	48 26
82	38 96	48 52
05	39 21	49 00
28	39 46	49 26
51	39 71	49 52
74	39 96	50 00
97	40 21	50 26
20	40 46	50 52
43	40 71	51 00
66	40 96	51 26
89	41 21	51 52
12	41 46	52 00
35	41 71	52 26
58	41 96	52 52
81	42 21	53 00
04	42 46	53 26
27	42 71	53 52
50	42 96	54 00
73	43 21	54 26
96	43 46	54 52
19	43 71	55 00
42	43 96	55 26
65	44 21	55 52
88	44 46	56 00
11	44 71	56 26
34	44 96	56 52
57	45 21	57 00
80	45 46	57 26
03	45 71	57 52
26	45 96	58 00
49	46 21	58 26
72	46 46	58 52
95	46 71	59 00
18	46 96	59 26
41	47 21	59 52
64	47 46	60 00
87	47 71	60 26
10	47 96	60 52
33	48 21	61 00
56	48 46	61 26
79	48 71	61 52
02	48 96	62 00
25	49 21	62 26
48	49 46	62 52
71	49 71	63 00
94	49 96	63 26
17	50 21	63 52
40	50 46	64 00
63	50 71	64 26
86	50 96	64 52
09	51 21	65 00
32	51 46	65 26
55	51 71	65 52
78	51 96	66 00
01	52 21	66 26
24	52 46	66 52
47	52 71	67 00
70	52 96	67 26
93	53 21	67 52
16	53 46	68 00
39	53 71	68 26
62	53 96	68 52
85	54 21	69 00
08	54 46	69 26
31	54 71	69 52
54	54 96	70 00
77	55 21	70 26
00	55 46	70 52
23	55 71	71 00
46	55 96	71 26
69	56 21	71 52
92	56 46	72 00
15	56 71	72 26
38	56 96	72 52
61	57 21	73 00
84	57 46	73 26
07	57 71	73 52
30	57 96	74 00
53	58 21	74 26
76	58 46	74 52
99	58 71	75 00
22	58 96	75 26
45	59 21	75 52
68	59 46	76 00
91	59 71	76 26
14	59 96	76 52
37	60 21	77 00
60	60 46	77 26
83	60 71	77 52
06	60 96	78 00
29	61 21	78 26
52	61 46	78 52
75	61 71	79 00
98	61 96	79 26
21	62 21	79 52
44	62 46	80 00
67	62 71	80 26
90	62 96	80 52
13	63 21	81 00
36	63 46	81 26
59	63 71	81 52
82	63 96	82 00
05	64 21	82 26
28	64 46	82 52
51	64 71	83 00
74	64 96	83 26
97	65 21	83 52
20	65 46	84 00
43	65 71	84 26
66	65 96	84 52
89	66 21	85 00
12	66 46	85 26
35	66 71	85 52
58	66 96	86 00
81	67 21	86 26
04	67 46	86 52
27	67 71	87 00
50	67 96	87 26
73	68 21	87 52
96	68 46	88 00
19	68 71	88 26
42	68 96	88 52
65	69 21	89 00
88	69 46	89 26
11	69 71	89 52
34	69 96	90 00
57	70 21	90 26
80	70 46	90 52
03	70 71	91 00
26	70 96	91 26
49	71 21	91 52
72	71 46	92 00
95	71 71	92 26
18	71 96	92 52
41	72 21	93 00
64	72 46	93 26
87	72 71	93 52
10	72 96	94 00
33	73 21	94 26
56	73 46	94 52
79	73 71	95 00
02	73 96	95 26
25	74 21	95 52
48	74 46	96 00
71	74 71	96 26
94	74 96	96 52
17	75 21	97 00
40	75 46	97 26
63	75 71	97 52
86	75 96	98 00
09	76 21	98 26
32	76 46	98 52
55	76 71	99 00
78	76 96	99 26
01	77 21	99 52
24	77 46	100 00
47	77 71	100 26
70	77 96	100 52
93	78 21	101 00
16	78 46	101 26
39	78 71	101 52
62	78 96	102 00
85	79 21	102 26
08	79 46	102 52
31	79 71	103 00
54	79 96	103 26
77	80 21	103 52
00	80 46	104 00
23	80 71	104 26
46	80 96	104 52
69	81 21	105 00
92	81 46	105 26
15	81 71	105 52
38	81 96	106 00
61	82 21	106 26
84	82 46	106 52
07	82 71	107 00
30	82 96	107 26
53	83 21	107 52
76	83 46	108 00
99	83 71	108 26
22	83 96	108 52
45	84 21	109 00
68	84 46	109 26
91	84 71	109 52
14	84 96	110 00
37	85 21	110 26
60	85 46	110 52
83	85 71	111 00
06	85 96	111 26
29	86 21	111 52
52	86 46	112 00
75	86 71	112 2

READY RECKONER.

The first column on the left contains the NUMBER of the Article, and the column on the tops of the Tables, the PRICE.

Nos.	22 ct.	23 ct.	24 ct.	25 ct.	26 ct.	27 ct.	28 ct.	29 ct.	30 ct.	31 ct.	31 1/2 ct.
2	.44	.46	.48	.50	.52	.54	.56	.58	.60	.62	.62 1/2
3	.66	.69	.72	.75	.78	.81	.84	.87	.90	.93	.93 1/2
4	.88	.92	.96	1.00	1.04	1.08	1.12	1.16	1.20	1.24	1.25
5	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.55	1.56 1/2
6	1.32	1.38	1.44	1.50	1.56	1.62	1.68	1.74	1.80	1.86	1.87 1/2
7	1.54	1.61	1.68	1.75	1.82	1.89	1.96	2.03	2.10	2.17	2.18 1/2
8	1.76	1.84	1.92	2.00	2.08	2.16	2.24	2.32	2.40	2.48	2.50
9	1.98	2.07	2.16	2.25	2.34	2.43	2.52	2.61	2.70	2.79	2.81 1/2
10	2.20	2.30	2.40	2.50	2.60	2.70	2.80	2.90	3.00	3.10	3.12 1/2
11	2.42	2.53	2.64	2.75	2.86	2.97	3.08	3.19	3.30	3.41	3.43 1/2
12	2.64	2.76	2.88	3.00	3.12	3.24	3.36	3.48	3.60	3.72	3.75
13	2.86	2.99	3.12	3.25	3.38	3.51	3.64	3.77	3.90	4.03	4.06 1/2
14	3.08	3.22	3.36	3.50	3.64	3.78	3.92	4.06	4.20	4.34	4.37 1/2
15	3.30	3.45	3.60	3.75	3.90	4.05	4.20	4.35	4.50	4.65	4.68 1/2
16	3.52	3.68	3.84	4.00	4.16	4.32	4.48	4.64	4.80	4.96	5.00
17	3.74	3.91	4.08	4.25	4.42	4.59	4.76	4.93	5.10	5.27	5.31 1/2
18	3.96	4.14	4.32	4.50	4.68	4.86	5.04	5.22	5.40	5.58	5.62 1/2
19	4.18	4.37	4.56	4.75	4.94	5.13	5.32	5.51	5.70	5.89	5.93 1/2
20	4.40	4.60	4.80	5.00	5.20	5.40	5.60	5.80	6.00	6.20	6.25
25	5.50	5.75	6.00	6.25	6.50	6.75	7.00	7.25	7.50	7.75	7.81 1/2
30	6.60	6.90	7.20	7.50	7.80	8.10	8.40	8.70	9.00	9.30	9.37 1/2
40	8.80	9.20	9.60	10.00	10.40	10.80	11.20	11.60	12.00	12.40	12.50
50	11.00	11.50	12.00	12.50	13.00	13.50	14.00	14.50	15.00	15.50	15.62 1/2
60	13.20	13.80	14.40	15.00	15.60	16.20	16.80	17.40	18.00	18.60	18.75
70	15.40	16.10	16.80	17.50	18.20	18.90	19.60	20.30	21.00	21.70	21.87 1/2
80	17.60	18.40	19.20	20.00	20.80	21.60	22.40	23.20	24.00	24.80	25.00
90	19.80	20.70	21.60	22.50	23.40	24.30	25.20	26.10	27.00	27.90	28.12 1/2
100	22.00	22.00	24.00	25.00	26.00	27.00	28.00	29.00	30.00	31.00	31.25
Nos.	32 ct.	33 ct.	34 ct.	35 ct.	36 ct.	37 ct.	37 1/2 ct.	38 ct.	39 ct.	40 ct.	
2	.64	.66	.68	.70	.72	.74	.75	.76	.78	.80	
3	.96	.99	1.00	1.02	1.05	1.08	1.11	1.12 1/2	1.14	1.17	1.20
4	1.28	1.32	1.33 1/2	1.36	1.40	1.44	1.48	1.50	1.52	1.56	1.60
5	1.60	1.65	1.66 1/2	1.70	1.75	1.80	1.85	1.87 1/2	1.90	1.95	2.00
6	1.92	1.99	2.00	2.04	2.10	2.16	2.22	2.25	2.28	2.34	2.40
7	2.24	2.31	2.33 1/2	2.38	2.45	2.52	2.59	2.62 1/2	2.66	2.73	2.80
8	2.56	2.64	2.66 1/2	2.72	2.80	2.88	2.96	3.00	3.04	3.12	3.20
9	2.88	2.97	3.00	3.08	3.15	3.24	3.33	3.37 1/2	3.42	3.51	3.60
10	3.20	3.30	3.33 1/2	3.40	3.50	3.60	3.70	3.75	3.80	3.90	4.00
11	3.52	3.63	3.66 1/2	3.74	3.85	3.96	4.07	4.12 1/2	4.18	4.29	4.40
12	3.84	3.96	4.00	4.08	4.20	4.32	4.44	4.50	4.56	4.68	4.80
13	4.16	4.29	4.33 1/2	4.42	4.55	4.68	4.81	4.87 1/2	4.94	5.07	5.20
14	4.48	4.62	4.66 1/2	4.76	4.90	5.04	5.18	5.25	5.32	5.46	5.60
15	4.80	4.95	5.00	5.10	5.25	5.40	5.55	5.62 1/2	5.70	5.85	6.00
16	5.12	5.28	5.33 1/2	5.44	5.60	5.76	5.92	6.00	6.08	6.24	6.40
17	5.44	5.61	5.66 1/2	5.78	5.95	6.12	6.29	6.37 1/2	6.46	6.63	6.80
18	5.76	5.94	6.00	6.12	6.30	6.48	6.66	6.75	6.84	7.02	7.20
19	6.08	6.27	6.33 1/2	6.46	6.65	6.84	7.03	7.12 1/2	7.22	7.41	7.60
20	6.40	6.60	6.66 1/2	6.80	7.00	7.20	7.40	7.50	7.60	7.80	8.00
25	8.00	8.25	8.33 1/2	8.50	8.75	9.00	9.25	9.37 1/2	9.50	9.75	10.00
30	9.60	9.90	10.00	10.20	10.50	10.80	11.10	11.25	11.40	11.70	12.00
40	12.80	13.20	13.33 1/2	13.60	14.00	14.40	14.80	15.00	15.20	15.60	16.00
50	16.00	16.50	16.66 1/2	17.00	17.50	18.00	18.50	18.75	19.00	19.50	20.00
60	19.20	19.80	20.00	20.40	21.00	21.60	22.20	22.50	22.80	23.40	24.00
70	22.40	23.10	23.33 1/2	23.80	24.50	25.20	25.90	26.25	26.60	27.30	28.00
80	25.60	26.40	26.66 1/2	27.20	28.00	28.80	29.60	30.00	30.40	31.20	32.00
90	28.80	29.70	30.00	30.60	31.50	32.40	33.30	33.75	34.20	35.10	36.00
100	32.00	33.00	33.33 1/2	34.00	35.00	36.00	37.00	37.50	38.00	39.00	40.00

READY RECKONER.

The first column on the left contains the NUMBER of the Article, and the column on the tops of the Tables, the PRICE.

Article, and the
E.

ct. 31 ct. 31 ct.

0	.62	.62
10	.93	.93
20	1.24	1.25
30	1.55	1.56
40	1.86	1.87
50	2.17	2.18
60	2.48	2.50
70	2.79	2.81
80	3.10	3.12
90	3.41	3.43
00	3.72	3.75
10	4.03	4.06
20	4.34	4.37
30	4.65	4.68
40	4.96	5.00
50	5.27	5.31
60	5.58	5.62
70	5.89	5.93
80	6.20	6.25
90	6.51	6.56
00	6.82	6.88
10	7.13	7.19
20	7.44	7.50
30	7.75	7.81
40	8.06	8.13
50	8.37	8.44
60	8.68	8.75
70	8.99	9.06
80	9.30	9.37
90	9.61	9.68
00	9.92	10.00
10	10.23	10.31
20	10.54	10.62
30	10.85	10.93
40	11.16	11.25
50	11.47	11.56
60	11.78	11.87
70	12.09	12.18
80	12.40	12.50
90	12.71	12.81
00	13.02	13.12
10	13.33	13.43
20	13.64	13.74
30	13.95	14.05
40	14.26	14.36
50	14.57	14.67
60	14.88	15.00
70	15.19	15.31
80	15.50	15.62
90	15.81	15.93
00	16.12	16.25
10	16.43	16.56
20	16.74	16.87
30	17.05	17.18
40	17.36	17.49
50	17.67	17.80
60	17.98	18.11
70	18.29	18.42
80	18.60	18.73
90	18.91	19.04
00	19.22	19.33
10	19.53	19.64
20	19.84	19.95
30	20.15	20.26
40	20.46	20.57
50	20.77	20.88
60	21.08	21.19
70	21.39	21.50
80	21.70	21.81
90	22.01	22.12
00	22.32	22.43
10	22.63	22.74
20	22.94	23.05
30	23.25	23.36
40	23.56	23.67
50	23.87	23.98
60	24.18	24.29
70	24.49	24.60
80	24.80	24.91
90	25.11	25.22
00	25.42	25.53
10	25.73	25.84
20	26.04	26.15
30	26.35	26.46
40	26.66	26.77
50	26.97	27.08
60	27.28	27.39
70	27.59	27.70
80	27.90	28.01
90	28.21	28.32
00	28.52	28.63
10	28.83	28.94
20	29.14	29.25
30	29.45	29.56
40	29.76	29.87
50	30.07	30.18
60	30.38	30.49
70	30.69	30.80
80	31.00	31.11
90	31.31	31.42
00	31.62	31.73
10	31.93	32.04
20	32.24	32.35
30	32.55	32.66
40	32.86	32.97
50	33.17	33.28
60	33.48	33.59
70	33.79	33.90
80	34.10	34.21
90	34.41	34.52
00	34.72	34.83
10	35.03	35.14
20	35.34	35.45
30	35.65	35.76
40	35.96	36.07
50	36.27	36.38
60	36.58	36.69
70	36.89	37.00
80	37.20	37.31
90	37.51	37.62
00	37.82	37.93
10	38.13	38.24
20	38.44	38.55
30	38.75	38.86
40	39.06	39.17
50	39.37	39.48
60	39.68	39.79
70	39.99	40.10
80	40.30	40.41
90	40.61	40.72
00	40.92	41.03
10	41.23	41.34
20	41.54	41.65
30	41.85	41.96
40	42.16	42.27
50	42.47	42.58
60	42.78	42.89
70	43.09	43.20
80	43.40	43.51
90	43.71	43.82
00	44.02	44.13
10	44.33	44.44
20	44.64	44.75
30	44.95	45.06
40	45.26	45.37
50	45.57	45.68
60	45.88	45.99
70	46.19	46.30
80	46.50	46.61
90	46.81	46.92
00	47.12	47.23
10	47.43	47.54
20	47.74	47.85
30	48.05	48.16
40	48.36	48.47
50	48.67	48.78
60	48.98	49.09
70	49.29	49.40
80	49.60	49.71
90	49.91	50.02
00	50.22	50.33
10	50.53	50.64
20	50.84	50.95
30	51.15	51.26
40	51.46	51.57
50	51.77	51.88
60	52.08	52.19
70	52.39	52.50
80	52.70	52.81
90	53.01	53.12
00	53.32	53.43
10	53.63	53.74
20	53.94	54.05
30	54.25	54.36
40	54.56	54.67
50	54.87	54.98
60	55.18	55.29
70	55.49	55.60
80	55.80	55.91
90	56.11	56.22
00	56.42	56.53
10	56.73	56.84
20	57.04	57.15
30	57.35	57.46
40	57.66	57.77
50	57.97	58.08
60	58.28	58.39
70	58.59	58.70
80	58.90	59.01
90	59.21	59.32
00	59.52	59.63
10	59.83	59.94
20	60.14	60.25
30	60.45	60.56
40	60.76	60.87
50	61.07	61.18
60	61.38	61.49
70	61.69	61.80
80	62.00	62.11
90	62.31	62.42
00	62.62	62.73
10	62.93	63.04
20	63.24	63.35
30	63.55	63.66
40	63.86	63.97
50	64.17	64.28
60	64.48	64.59
70	64.79	64.90
80	65.10	65.21
90	65.41	65.52
00	65.72	65.83
10	66.03	66.14
20	66.34	66.45
30	66.65	66.76
40	66.96	67.07
50	67.27	67.38
60	67.58	67.69
70	67.89	68.00
80	68.20	68.31
90	68.51	68.62
00	68.82	68.93
10	69.13	69.24
20	69.44	69.55
30	69.75	69.86
40	70.06	70.17
50	70.37	70.48
60	70.68	70.79
70	70.99	71.10
80	71.30	71.41
90	71.61	71.72
00	71.92	72.03
10	72.23	72.34
20	72.54	72.65
30	72.85	72.96
40	73.16	73.27
50	73.47	73.58
60	73.78	73.89
70	74.09	74.20
80	74.40	74.51
90	74.71	74.82
00	75.02	75.13
10	75.33	75.44
20	75.64	75.75
30	75.95	76.06
40	76.26	76.37
50	76.57	76.68
60	76.88	76.99
70	77.19	77.30
80	77.50	77.61
90	77.81	77.92
00	78.12	78.23
10	78.43	78.54
20	78.74	78.85
30	79.05	79.16
40	79.36	79.47
50	79.67	79.78
60	79.98	80.09
70	80.29	80.40
80	80.60	80.71
90	80.91	81.02
00	81.22	81.33
10	81.53	81.64
20	81.84	81.95
30	82.15	82.26
40	82.46	82.57
50	82.77	82.88
60	83.08	83.19
70	83.39	83.50
80	83.70	83.81
90	84.01	84.12
00	84.32	84.43
10	84.63	84.74
20	84.94	85.05
30	85.25	85.36
40	85.56	85.67
50	85.87	85.98
60	86.18	86.29
70	86.49	86.60
80	86.80	86.91
90	87.11	87.22
00	87.42	87.53
10	87.73	87.84
20	88.04	88.15
30	88.35	88.46
40	88.66	88.77
50	88.97	89.08
60	89.28	89.39
70	89.59	89.70
80	89.90	90.01
90	90.21	90.32
00	90.52	90.63
10	90.83	90.94
20	91.14	91.25
30	91.45	91.56
40	91.76	91.87
50	92.07	92.18
60	92.38	92.49
70	92.69	92.80
80	93.00	93.11
90	93.31	93.42
00	93.62	93.73
10	93.93	94.04
20	94.24	94.35
30	94.55	94.66
40	94.86	94.97
50	95.17	95.28
60	95.48	95.59
70	95.79	95.90
80	96.10	96.21
90	96.41	96.52
00	96.72	96.83
10	97.03	97.14
20	97.34	97.45
30	97.65	97.76
40	97.96	98.07
50	98.27	98.38
60	98.58	98.69
70	98.89	99.00
80	99.20	99.31
90	99.51	99.62
00	99.82	99.93
10	100.13	100.24
20	100.44	100.55
30	100.75	100.86
40	101.06	101.17
50	101.37	101.48
60	101.68	101.79
70	101.99	102.10
80	102.30	102.41
90	102.61	102.72
00	102.92	103.03
10	103.23	103.34
20	103.54	103.65
30	103.85	103.96
40	104.16	104.27
50	104.47	104.58
60	104.78	104.89
70	105.09	105.20
80	105.40	105.51
90	105.71	105.82
00	106.02	106.13
10	106.33	106.44
20	106.64	106.75
30	106.95	107.06
40	107.26	107.37
50	107.57	107.68
60	107.88	107.99
70	108.19	108.30
80	108.50	108.61
90	108.81	108.92
00	109.12	109.23
10	109.43	109.54
20	109.74	109.85
30	110.05	110.16
40	110.36	110.47
50	110.67	110.78
60	110.98	111.09
70	111.29	111.40
80	111.60	111.71
90	111.91	112.02
00	112.22	112.33
10	112.53	112.64
20	112.84	112.95
30	113.15	113.26
40	113.46	113.57
50	113.77	113.88
60	114.08	114.19
70	114.39	114.50
80	114.70	114.81
90	115.01	115.12
00	115.32	115.43
10	115.63	115.74
20	115.94	116.05
30	116.25	116.36
40	116.56	116.67
50	116.87	116.98
60	117.18	117.29
70	117.49	117.60
80	117.80</	

READY RECKONER:

If the Number required is not found in the Tables, add two Numbers together; for instance, if 35 bushels are required, add the prices opposite 30 and 5 together, and so for 35 bushels—treble the value of 100, and 60 and 5 together.

Nos	62 ct.	63 ct.	64 ct.	65 ct.	66 ct.	66½ ct.	67 ct.	68 ct.	69 ct.	70 ct.	71 ct.
2	1.25	1.26	1.28	1.30	1.32	1.33½	1.34	1.36	1.38	1.40	1.42
3	1.87½	1.89	1.92	1.95	1.98	2.00	2.01	2.04	2.07	2.10	2.13
4	2.50	2.52	2.56	2.60	2.64	2.66½	2.68	2.72	2.76	2.80	2.84
5	3.12	3.15	3.20	3.25	3.30	3.33½	3.35	3.40	3.45	3.50	3.55
6	3.75	3.78	3.84	3.90	3.96	4.00	4.02	4.08	4.14	4.20	4.26
7	4.37½	4.41	4.48	4.55	4.62	4.66½	4.69	4.76	4.83	4.90	4.97
8	5.00	5.04	5.12	5.20	5.28	5.33½	5.36	5.44	5.52	5.60	5.68
9	5.62½	5.67	5.76	5.85	5.94	6.00	6.03	6.12	6.21	6.30	6.39
10	6.25	6.30	6.40	6.50	6.60	6.66½	6.70	6.80	6.90	7.00	7.10
11	6.87½	6.93	7.04	7.15	7.26	7.33½	7.37	7.48	7.59	7.70	7.81
12	7.50	7.56	7.68	7.80	7.92	8.00	8.04	8.16	8.28	8.40	8.52
13	8.12½	8.19	8.32	8.45	8.58	8.66½	8.71	8.84	8.97	9.10	9.23
14	8.75	8.80	8.95	9.10	9.24	9.33½	9.38	9.52	9.66	9.8	9.94
15	9.37½	9.45	9.60	9.75	9.90	10.00	10.05	10.20	10.35	10.50	10.65
16	10.00	10.08	10.24	10.40	10.56	10.66½	10.72	10.88	11.04	11.20	11.36
17	10.62½	10.71	10.88	11.05	11.22	11.33½	11.39	11.56	11.73	11.90	12.07
18	11.25	11.34	11.52	11.70	11.88	12.00	12.06	12.24	12.42	12.60	12.78
19	11.87½	11.97	12.16	12.35	12.54	12.66½	12.73	12.92	13.11	13.30	13.49
20	12.50	12.60	12.80	13.00	13.20	13.33½	13.40	13.60	13.80	14.00	14.20
25	15.62½	15.75	16.00	16.25	16.50	16.66½	16.75	17.00	17.25	17.50	17.75
30	18.75	18.90	19.20	19.50	19.80	20.00	20.10	20.40	20.70	21.00	21.30
40	25.00	25.20	25.60	26.00	26.40	26.66½	26.80	27.20	27.60	28.00	28.40
50	31.25	31.50	32.00	32.50	33.00	33.33½	33.50	34.00	34.50	35.00	35.50
60	37.50	37.80	38.40	39.00	39.60	40.00	40.20	40.80	41.40	42.00	42.60
70	43.75	44.10	44.80	45.50	46.20	46.66½	46.90	47.60	48.30	49.00	49.70
80	50.00	50.40	51.20	52.00	52.80	53.33½	53.60	54.40	55.20	56.00	56.80
90	56.25	56.70	57.60	58.50	59.40	60.00	60.30	61.20	62.10	63.00	63.90
100	62.50	63.00	64.00	65.00	66.00	66.66½	67.00	68.00	69.00	70.00	71.00
Nos	72 ct.	73 ct.	74 ct.	75 ct.	76 ct.	77 ct.	78 ct.	79 ct.	80 ct.	81 ct.	82 ct.
2	1.44	1.46	1.48	1.50	1.52	1.54	1.56	1.58	1.60	1.62	1.64
3	2.16	2.19	2.22	2.25	2.28	2.31	2.34	2.37	2.40	2.43	2.46
4	2.88	2.92	2.96	3.01	3.04	3.08	3.12	3.16	3.20	3.24	3.28
5	3.60	3.65	3.70	3.75	3.80	3.85	3.90	3.95	4.00	4.05	4.10
6	4.32	4.38	4.44	4.50	4.56	4.62	4.68	4.74	4.80	4.86	4.92
7	5.04	5.11	5.18	5.25	5.32	5.39	5.46	5.53	5.60	5.67	5.74
8	5.76	5.84	5.92	6.00	6.08	6.16	6.24	6.32	6.40	6.48	6.56
9	6.48	6.57	6.66	6.75	6.84	6.93	7.02	7.11	7.20	7.29	7.38
10	7.20	7.30	7.40	7.50	7.60	7.70	7.80	7.90	8.00	8.10	8.20
11	7.92	8.03	8.14	8.25	8.36	8.47	8.58	8.69	8.80	8.91	9.02
12	8.64	8.76	8.88	9.00	9.12	9.24	9.36	9.48	9.60	9.72	9.84
13	9.36	9.49	9.62	9.75	9.88	10.01	10.14	10.27	10.40	10.53	10.66
14	10.08	10.22	10.36	10.50	10.64	10.78	10.92	1.06	1.10	1.14	1.18
15	10.80	10.95	11.10	11.25	11.40	11.55	11.70	11.85	12.00	12.15	12.30
16	11.52	11.68	11.84	12.00	12.16	12.32	12.48	12.64	12.80	12.96	13.12
17	12.24	12.41	12.58	12.75	12.92	13.09	13.26	13.43	13.60	13.77	13.94
18	12.96	13.14	13.32	13.50	13.68	13.86	14.04	14.22	14.40	14.58	14.76
19	13.68	13.87	14.06	14.25	14.44	14.63	14.82	15.01	15.20	15.39	15.58
20	14.40	14.60	14.80	15.00	15.20	15.40	15.60	15.80	16.00	16.20	16.40
25	18.00	18.25	18.50	18.75	19.00	19.25	19.50	19.75	20.00	20.25	20.50
30	21.60	21.90	22.20	22.50	22.80	23.10	23.40	23.70	24.00	24.30	24.60
40	28.80	29.20	29.60	30.00	30.40	30.80	31.20	31.60	32.00	32.40	32.80
50	36.00	36.50	37.00	37.50	38.00	38.50	39.00	39.50	40.00	40.50	41.00
60	43.20	43.80	44.40	45.00	45.60	46.20	46.80	47.40	48.00	48.60	49.20
70	50.40	51.10	51.80	52.50	53.20	53.90	54.60	55.30	56.00	56.70	57.40
80	57.60	58.40	59.20	60.00	60.80	61.60	62.40	63.20	64.00	64.80	65.60
90	64.80	65.70	66.60	67.50	68.40	69.30	70.20	71.10	72.00	72.90	73.80
100	72.00	73.00	74.00	75.00	76.00	77.00	78.00	79.00	80.00	81.00	82.00

READY RECKONER.

two Numbers to the prices opposite value of 100, and

If the Number required is not found in the Tables, add two Numbers together; for instance, if 35 bushels are required, add the prices opposite 20 and 5 together; and so for 365 bushels—treble the value of 100, and add 60 and 5 together.

9 ct.	70 ct.	71 ct.
1.38	1.40	1.42
2.07	2.10	2.13
2.76	2.80	2.84
3.45	3.50	3.55
4.14	4.20	4.26
4.83	4.90	4.97
5.52	5.60	5.68
6.21	6.30	6.39
6.90	7.00	7.10
7.59	7.70	7.81
8.28	8.40	8.52
8.97	9.10	9.23
9.66	9.80	9.94
10.35	10.50	10.65
11.04	11.20	11.36
11.73	11.90	12.07
12.42	12.60	12.78
13.11	13.30	13.49
13.80	14.00	14.20
14.49	14.70	14.91
15.18	15.40	15.62
15.87	16.10	16.33
16.56	16.80	17.04
17.25	17.50	17.76
17.94	18.20	18.47
18.63	18.90	19.19
19.32	19.60	19.82
20.01	20.30	20.54
20.70	21.00	21.26
21.39	21.70	21.98
22.08	22.40	22.70
22.77	23.10	23.32
23.46	23.80	24.04
24.15	24.50	24.76
24.84	25.20	25.48
25.53	25.90	26.20
26.22	26.60	26.92
26.91	27.30	27.64
27.60	28.00	28.36
28.29	28.70	29.08
28.98	29.40	29.80
29.67	30.10	30.52
30.36	30.80	31.24
31.05	31.50	31.96
31.74	32.20	32.68
32.43	32.90	33.40
33.12	33.60	34.12
33.81	34.30	34.84
34.50	35.00	35.56
35.19	35.70	36.28
35.88	36.40	37.00
36.57	37.10	37.72
37.26	37.80	38.44
37.95	38.50	39.16
38.64	39.20	39.88
39.33	39.90	40.60
40.02	40.60	41.32
40.71	41.30	42.04
41.40	42.00	42.76
42.09	42.70	43.48
42.78	43.40	44.20
43.47	44.10	44.92
44.16	44.80	45.64
44.85	45.50	46.36
45.54	46.20	47.08
46.23	46.90	47.80
46.92	47.60	48.52
47.61	48.30	49.24
48.30	49.00	49.96
48.99	49.70	50.68
49.68	50.40	51.40
50.37	51.10	52.12
51.06	51.80	52.84
51.75	52.50	53.56
52.44	53.20	54.28
53.13	53.90	55.00
53.82	54.60	55.72
54.51	55.30	56.44
55.20	56.00	57.16
55.89	56.70	57.88
56.58	57.40	58.60
57.27	58.10	59.32
57.96	58.80	60.04
58.65	59.50	60.76
59.34	60.20	61.48
60.03	60.90	62.20
60.72	61.60	62.92
61.41	62.30	63.64
62.10	63.00	64.36
62.79	63.70	65.08
63.48	64.40	65.80
64.17	65.10	66.52
64.86	65.80	67.24
65.55	66.50	67.96
66.24	67.20	68.68
66.93	67.90	69.40
67.62	68.60	70.12
68.31	69.30	70.84
69.00	70.00	71.56
69.69	70.70	72.28
70.38	71.40	73.00
71.07	72.10	73.72
71.76	72.80	74.44
72.45	73.50	75.16
73.14	74.20	75.88
73.83	74.90	76.60
74.52	75.60	77.32
75.21	76.30	78.04
75.90	77.00	78.76
76.59	77.70	79.48
77.28	78.40	80.20
77.97	79.10	80.92
78.66	79.80	81.64
79.35	80.50	82.36
80.04	81.20	83.08
80.73	81.90	83.80
81.42	82.60	84.52
82.11	83.30	85.24
82.80	84.00	85.96
83.49	84.70	86.68
84.18	85.40	87.40
84.87	86.10	88.12
85.56	86.80	88.84
86.25	87.50	89.56
86.94	88.20	90.28
87.63	88.90	91.00
88.32	89.60	91.72
89.01	90.30	92.44
89.70	91.00	93.16
90.39	91.70	93.88
91.08	92.40	94.60
91.77	93.10	95.32
92.46	93.80	96.04
93.15	94.50	96.76
93.84	95.20	97.48
94.53	95.90	98.20
95.22	96.60	98.92
95.91	97.30	99.64
96.60	98.00	100.36
97.29	98.70	101.08
97.98	99.40	101.80
98.67	100.10	102.52
99.36	100.80	103.24
100.05	101.50	103.96
100.74	102.20	104.68
101.43	102.90	105.40
102.12	103.60	106.12
102.81	104.30	106.84
103.50	105.00	107.56
104.19	105.70	108.28
104.88	106.40	109.00
105.57	107.10	109.72
106.26	107.80	110.44
106.95	108.50	111.16
107.64	109.20	111.88
108.33	109.90	112.60
109.02	110.60	113.32
109.71	111.30	114.04
110.40	112.00	114.76
111.09	112.70	115.48
111.78	113.40	116.20
112.47	114.10	116.92
113.16	114.80	117.64
113.85	115.50	118.36
114.54	116.20	119.08
115.23	116.90	119.80
115.92	117.60	120.52
116.61	118.30	121.24
117.30	119.00	121.96
117.99	119.70	122.68
118.68	120.40	123.40
119.37	121.10	124.12
120.06	121.80	124.84
120.75	122.50	125.56
121.44	123.20	126.28
122.13	123.90	127.00
122.82	124.60	127.72
123.51	125.30	128.44
124.20	126.00	129.16
124.89	126.70	130.00
125.58	127.40	130.84
126.27	128.10	131.68
126.96	128.80	132.52
127.65	129.50	133.36
128.34	130.20	134.20
129.03	130.90	135.04
129.72	131.60	135.88
130.41	132.30	136.72
131.10	133.00	137.56
131.79	133.70	138.40
132.48	134.40	139.24
133.17	135.10	140.08
133.86	135.80	140.92
134.55	136.50	141.76
135.24	137.20	142.60
135.93	137.90	143.44
136.62	138.60	144.28
137.31	139.30	145.12
138.00	140.00	145.96
138.69	140.70	146.80
139.38	141.40	147.64
140.07	142.10	148.48
140.76	142.80	149.32
141.45	143.50	150.16
142.14	144.20	151.00
142.83	144.90	151.84
143.52	145.60	152.68
144.21	146.30	153.52
144.90	147.00	154.36
145.59	147.70	155.20
146.28	148.40	156.04
146.97	149.10	156.88
147.66	149.80	157.72
148.35	150.50	158.56
149.04	151.20	159.40
149.73	151.90	160.24
150.42	152.60	161.08
151.11	153.30	161.92
151.80	154.00	162.76
152.49	154.70	163.60
153.18	155.40	164.44
153.87	156.10	165.28
154.56	156.80	166.12
155.25	157.50	166.96
155.94	158.20	167.80
156.63	158.90	168.64
157.32	159.60	169.48
158.01	160.30	170.32
158.70	161.00	171.16
159.39	161.70	172.00
160.08	162.40	172.84
160.77	163.10	173.68
161.46	163.80	174.52
162.15	164.50	175.36
162.84	165.20	176.20
163.53	165.90	177.04
164.22	166.60	177.88
164.91	167.30	178.72
165.60	168.00	179.56
166.29	168.70	180.40
166.98	169.40	181.24
167.67	170.10	182.08
168.36	170.80	182.92
169.05	171.50	183.76
169.74	172.20	184.60
170.43	172.90	185.44
171.12	173.60	186.28
171.81	174.30	187.12
172.50	175.00	187.96
173.19	175.70	188.80
173.88	176.40	189.64
174.57	177.10	190.48
175.26	177.80	191.32
175.95	178.50	192.16
176.64	179.20	193.00
177.33	179.90	193.84
178.02	180.60	194.68
178.71	181.30	195.52
179.40	182.00	196.36
180.09	182.70	197.20
180.78	183.40	198.04
181.47	184.10	198.88
182.16	184.80	199.72
182.85	185.50	200.56
183.54	186.20	201.40
184.23	186.90	202.24
184.92	187.60	203.08
185.61	188.30	203.92
186.30	189.00	204.76
186.99	189.70	205.60
187.68	190.40	206.44
188.37	191.10	207.28
189.06	191.80	208.12
189.75	192.50	208.96
190.44	193.20	209.80
191.13	193.90	210.64
191.82	194.60	211.48
192.51	195.30	212.32
193.20	196.00	213.16
193.89	196.70	214.00
194.58	197.40	214.84
195.27	198.10	215.68
195.96	198.80	216.52
196.65	199.50	217.36
197.34	200.20	218.20
198.03	200.90	219.04
198.72	201.60	219.88
199.41	202.30	220.72
200.10	203.00	221.56
200.79	203.70	222.40
201.48	204.40	223.24
202.17	205.10	224.08
202.86	205.80	224.92
203.55	206.50	225.76
204.24	207.20	226.60
204.93	207.90	227.44
205.62	208.60	228.28
206.31	209.30	229.12
207.00	210.00	230.00

Nos	83 ct.	84 ct.	85 ct.	86 c.	87 ct.	87½ ct.	88 ct.	89 ct.	90 ct.	91 ct.	92 ct.
2	1.66	1.68	1.70	1.72	1.74	1.75	1.76	1.78	1.80	1.82	1.84
3	2.49	2.52	2.55	2.28	2.61	2.62½	2.64	2.67	2.70	2.73	2.76
4	3.32	3.36	3.40	3.44	3.48	3.50	3.52	3.56	3.60	3.64	3.68
5	4.15	4.20	4.25	4.30	4.35	4.37½	4.40	4.45	4.50	4.55	4.60
6	4.98	5.04	5.10	5.16	5.22	5.25	5.28	5.34	5.40	5.46	5.52
7	5.81	5.88	5.95	6.02	6.09	6.12½	6.16	6.23	6.30	6.37	6.44
8	6.64	6.72	6.80	6.88	6.96	7.00	7.04	7.12	7.20	7.28	7.36
9	7.47	7.56	7.65	7.74	7.83	7.87½	7.92	8.01	8.10	8.19	8.28
10	8.30	8.40	8.50	8.60	8.70	8.75	8.80	8.90	9.00	9.10	9.20
11	9.13	9.24	9.35	9.46	9.57	9.62½	9.68	9.79	9.90	10.01	10.12
12	9.96	10.08	10.20	10.32	10.44	10.50	10.56	10.68	10.80	10.92	11.04
13	10.79	10.92	11.05	11.18	11.31	11.37½	11.44	11.57	11.70	11.83	11.96
14	11.62	11.76	11.90	12.04	12.18	12.25	12.32	12.46	12.60	12.74	12.88
15	12.45	12.60	12.75	12.90	13.06	13.12½	13.20	13.35	13.50	13.65	13.80
16	13.28	13.44	13.60	13.76	13.92	14.00	14.08	1.24	14.40	14.56	14.72
17	14.11	14.28	14.45	14.62	14.79	14.87½	14.96	15.13	15.30	15.47	15.64
18	14.94	15.12	15.30	15.48	15.66	15.75	15.84	16.02	16.20	16.38	16.56
19	15.77	15.96	16.15	16.34	16.53	16.62½	16.72	16.91	17.10	17.29	17.48
20	16.60	16.80	17.00	17.20	17.40	17.50	17.60	17.80	18.00	18.20	18.40
25	20.75	21.00	21.25	21.50	21.75	21.87½	22.00	22.25	22.50	22.75	23.00
30	24.90	25.20	25.50	25.80	26.10	26.25	26.40	26.70	27.00	27.30	27.60
40	33.20	33.60	34.00	34.40	34.80	35.00	35.20	35.60	36.00	36.40	36.80
50	41.50	42.00	42.50	43.00	43.50	43.75	44.00	44.50	45.00	45.50	46.00
60	49.80	50.40	51.00	51.60	52.20	52.50	52.80	53.40	54.00	54.60	55.20
70	58.10	58.80	59.50	60.20	60.90	61.25	61.60	62.30	63.00	63.70	64.40
80	66.40	67.20	68.00	68.80	69.60	70.00	70.40	71.20	72.00	72.80	73.60
90	74.70	75.60	76.50	77.40	78.30	78.75	79.20	80.10	81.00	81.90	82.80
100	83.00	84.00	85.00	86.00	87.00	87.50	88.00	89.00	90.00	91.00	92.00

SCANTLING REDUCED TO ONE INCH BOARD MEASURE.

SCANTLING AND TIMBER MEASURE

REDUCED TO ONE INCH BOARD MEASURE.

EXPLANATION.—To ascertain the number of Feet of Scantling or Timber, say 18 Feet Long and 2 by 3 Inches. Find 2 by 3 in the top columns, and 18 in the left hand column, and under 2 by 3 and against 18 is 9 feet.

If the Scantling is longer than contained in the Table, add two lengths together. If shorter, take part of some length.

Feet	THICKNESS AND WIDTH IN INCHES.																		
	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.4			
6	2	3	4	5	6	7	8	9	4.6	6	7	6	9	10.6	12	13.6	8		
7	2.4	3.6	4.8	5.10	7	8	2	9.4	10.6	5.3	7	8	9	10.6	12.3	14	15.9	9.4	
8	2.8	4	5.4	6	8	9	4	10.8	12	6	8	10	12	14	16	18	10		
9	3	4.6	6	7	6	9	10	6	12	13.6	6.9	9	11.3	13.6	15.9	18	20	12	
10	3.4	5	6.8	8	4	10	11	8	13.4	15	7.6	10	12.6	15	17.6	20	22.6	13.4	
11	3.8	5.6	7.4	9	2	11	12	10	14.8	16.6	8.3	11	13.9	16.6	19	22	24.9	14.8	
12	4	6	8	10	12	14	16	18	9	12	15	18	21	24	27	30	33	16	
13	4.4	6.6	8.8	10	10	13	15	2	17.4	19.6	9.9	13	16.3	19.6	22.9	26	29.3	17.4	
14	4.8	7	9.4	11	8	14	16	4	18.8	21	10.6	14	17.6	21	24.6	28	31.6	18.8	
15	5	7.6	10	12	6	15	17	6	20	22.6	11.3	15	18.9	22.6	26	30	33.9	20	
16	5.4	8	10.8	13	4	16	18	8	21.4	24	12	16	20	24	28	32	36	21.4	
17	5.8	8.6	11.4	14	2	17	19	10	22.8	25.6	12.9	17	21.3	25.6	29.9	34	38.3	22.8	
18	6	9	12	15	18	21	24	27	13	6	18	22	26	27	31	36	40	24	
19	6.4	9.6	12.8	15	10	19	22	2	25.4	28.6	14	3	19	23.9	28.6	33	38	25.4	
20	6.8	10	13.4	16	8	20	23	4	26.8	30	15	20	25	30	35	40	45	26.8	
21	7	10.6	14	17	6	21	24	6	28	31.6	15.9	21	26	31	36	42	47	28	
22	7.4	11	14.8	18	4	22	25	8	29.4	33	16.3	22	27	33	38	44	49	29.4	
23	7.8	11.6	15.4	19	2	23	26	10	30.8	34.6	17	3	28	34	40	46	51	30.8	
24	8	12	16	20	24	28	32	36	18	24	30	36	42	48	54	62	70		
25	8.4	12.6	16.8	20	10	25	29	2	33	37	6	18	31	37	43	50	58	33.4	
30	10	15	20	25	30	35	40	45	22	6	30	37	45	52	60	67	76	40	
31	11.4	17	22	28	4	34	39	3	45.4	51	25	6	42	51	59	68	76	45.4	
40	13.4	20	26.8	33	4	40	46	8	53.4	60	30	0	40	50	60	70	80	53	

Feet	THICKNESS AND WIDTH IN INCHES.																		
	5.4	4.6	4.7	4.8	4.9	5.5	5.6	5.7	5.8	5.9	6.6	6.7	6.8	6.9	6.10				
6	10	12	14	16	18	12	6	15	17	6	20	22	6	18	21	24	27	30	
7	11.8	14	16.4	18.8	21	14	7	17.6	20	5	23.4	26	3	21	24	28	31.6	35	
8	13.4	16	18.8	21.4	24	16	8	20	23	4	26.8	30	24	28	32	36	40	45	
9	15	18	21	24	27	18	9	22.6	25	3	30	33	9	27	31	36	40	45	
10	16.8	20	23.4	26.8	30	20	10	25	29	2	33.4	37	6	30	35	40	45	50	
11	18.4	22	25.8	29.4	33	22	11	27.6	32	1	36.8	41	3	33	38	44	49	55	
12	20	24	28	32	36	25	30	35	40	45	36	42	48	54	60				
13	21.8	26	30.4	34.8	39	27	1	32.6	37.11	43.4	48	9	45	52	58	65	72		
14	23.4	28	32.8	37.4	42	29	2	35	40.10	46.8	52	6	42	49	56	63	70		
15	25	30	35	40	45	31	3	37.6	43	9	50	56	3	45	52	60	67	75	
16	26.8	32	37.4	42.8	48	33	4	40	46	8	53.4	60	48	56	64	72	80		
17	28.4	34	39.8	45.4	51	35	5	42.6	49	7	56.8	63	9	61	69	78	86	95	
18	30	36	42	48	54	37	6	45	52	6	60	67	6	64	73	82	91	100	
19	31.8	38	44.4	50.8	57	39	7	47.6	55	5	63.4	71	3	67	76	85	94	103	
20	33.4	40	46.8	53.4	60	41	8	50	58	4	66.8	75	60	70	80	90	100		
21	35	42	49	56	63	43	9	52	6	81	3	70	78	88	98	108			
22	36.8	44	51.4	58.8	66	45	10	55	64	2	73.4	82	6	80	90	100			
23	38.4	46	53.8	61.4	69	47	11	57.6	67	1	76.8	86	3	83	93	103			
24	40	48	56	64	72	50		60	70		80	90	72	84	96	108	120		
25	41.8	50	58.4	66.8	75	52	1	62.6	72.11	83.4	93	9	75	87	6	100	112	125	
30	50	60	70	80	90	62	6	75	87	6	100	112	6	90	105	120	135	150	
31	51.8	63	75.4	87.8	100	64	10	85	99	2	113.4	127	6	102	119	136	153	170	
40	56.8	70	83.4	100.8	120	68	4	100	116.8	133	4	150	129	140	160	180	200		

D MEASURE.

RE

ASURE.

Scantling or Tim-
ber by 3 in the top
by 3 and against

add two lengths

3.7 3.8 3.9 4.4

10.6 12. 18.6 8.

12.3 14. 15.9 9.4

14. 16. 18. 10.7

15.9 18. 20.3 12.

17.6 20. 22.6 13.4

19.3 22. 24.9 14.8

21. 24. 27. 16.

22.9 26. 29.3 17.4

24.6 28. 31.6 18.8

26.3 30. 33.9 20.

28. 32. 36. 21.4

29.9 34. 38.3 22.8

31.6 36. 40.6 24.

33.3 38. 42.9 25.4

35. 40. 45. 26.8

36.36 42. 47.3 28.

38.6 44. 49.6 29.4

40.3 46. 51.9 30.8

42. 48. 54. 32.

44.2 49.50. 56.3 33.4

46.3 50. 56.3 34.4

48.6 52. 58.6 35.4

50.6 54. 60.6 36.4

52.6 56. 62.6 37.4

54.6 58. 64.6 38.4

56.6 60. 66.6 39.4

58.6 62. 68.6 40.4

60.6 64. 70.6 41.4

62.6 66. 72.6 42.4

64.6 68. 74.6 43.4

66.6 70. 76.6 44.4

68.6 72. 78.6 45.4

70.6 74. 80.6 46.4

72.6 76. 82.6 47.4

74.6 78. 84.6 48.4

76.6 80. 86.6 49.4

78.6 82. 88.6 50.4

80.6 84. 90.6 51.4

82.6 86. 92.6 52.4

84.6 88. 94.6 53.4

86.6 90. 96.6 54.4

88.6 92. 98.6 55.4

90.6 94. 100.6 56.4

92.6 96. 102.6 57.4

94.6 98. 104.6 58.4

96.6 100. 106.6 59.4

98.6 102. 108.6 60.4

100.6 104. 110.6 61.4

102.6 106. 112.6 62.4

104.6 108. 114.6 63.4

106.6 110. 116.6 64.4

108.6 112. 118.6 65.4

110.6 114. 120.6 66.4

112.6 116. 122.6 67.4

114.6 118. 124.6 68.4

116.6 120. 126.6 69.4

118.6 122. 128.6 70.4

120.6 124. 130.6 71.4

122.6 126. 132.6 72.4

124.6 128. 134.6 73.4

126.6 130. 136.6 74.4

128.6 132. 138.6 75.4

130.6 134. 140.6 76.4

132.6 136. 142.6 77.4

134.6 138. 144.6 78.4

136.6 140. 146.6 79.4

138.6 142. 148.6 80.4

140.6 144. 150.6 81.4

142.6 146. 152.6 82.4

144.6 148. 154.6 83.4

146.6 150. 156.6 84.4

148.6 152. 158.6 85.4

150.6 154. 160.6 86.4

152.6 156. 162.6 87.4

154.6 158. 164.6 88.4

156.6 160. 166.6 89.4

158.6 162. 168.6 90.4

160.6 164. 170.6 91.4

162.6 166. 172.6 92.4

164.6 168. 174.6 93.4

166.6 170. 176.6 94.4

168.6 172. 178.6 95.4

170.6 174. 180.6 96.4

172.6 176. 182.6 97.4

174.6 178. 184.6 98.4

176.6 180. 186.6 99.4

178.6 182. 188.6 100.4

180.6 184. 190.6 101.4

182.6 186. 192.6 102.4

184.6 188. 194.6 103.4

186.6 190. 196.6 104.4

188.6 192. 198.6 105.4

190.6 194. 200.6 106.4

192.6 196. 202.6 107.4

194.6 198. 204.6 108.4

196.6 200. 206.6 109.4

198.6 202. 208.6 110.4

200.6 204. 210.6 111.4

202.6 206. 212.6 112.4

204.6 208. 214.6 113.4

206.6 210. 216.6 114.4

208.6 212. 218.6 115.4

210.6 214. 220.6 116.4

212.6 216. 222.6 117.4

214.6 218. 224.6 118.4

216.6 220. 226.6 119.4

218.6 222. 228.6 120.4

220.6 224. 230.6 121.4

222.6 226. 232.6 122.4

224.6 228. 234.6 123.4

226.6 230. 236.6 124.4

228.6 232. 238.6 125.4

230.6 234. 240.6 126.4

232.6 236. 242.6 127.4

234.6 238. 244.6 128.4

236.6 240. 246.6 129.4

238.6 242. 248.6 130.4

240.6 244. 250.6 131.4

242.6 246. 252.6 132.4

244.6 248. 254.6 133.4

246.6 250. 256.6 134.4

248.6 252. 258.6 135.4

250.6 254. 260.6 136.4

252.6 256. 262.6 137.4

254.6 258. 264.6 138.4

256.6 260. 266.6 139.4

258.6 262. 268.6 140.4

260.6 264. 270.6 141.4

262.6 266. 272.6 142.4

264.6 268. 274.6 143.4

266.6 270. 276.6 144.4

268.6 272. 278.6 145.4

270.6 274. 280.6 146.4

272.6 276. 282.6 147.4

274.6 278. 284.6 148.4

276.6 280. 286.6 149.4

278.6 282. 288.6 150.4

280.6 284. 290.6 151.4

282.6 286. 292.6 152.4

284.6 288. 294.6 153.4

286.6 290. 296.6 154.4

288.6 292. 298.6 155.4

290.6 294. 300.6 156.4

292.6 296. 302.6 157.4

294.6 298. 304.6 158.4

296.6 300. 306.6 159.4

298.6 302. 308.6 160.4

300.6 304. 310.6 161.4

302.6 306. 312.6 162.4

304.6 308. 314.6 163.4

306.6 310. 316.6 164.4

308.6 312. 318.6 165.4

310.6 314. 320.6 166.4

312.6 316. 322.6 167.4

314.6 318. 324.6 168.4

316.6 320. 326.6 169.4

318.6 322. 328.6 170.4

320.6 324. 330.6 171.4

322.6 326. 332.6 172.4

324.6 328. 334.6 173.4

326.6 330. 336.6 174.4

328.6 332. 338.6 175.4

330.6 334. 340.6 176.4

332.6 336. 342.6 177.4

334.6 338. 344.6 178.4

336.6 340. 346.6 179.4

338.6 342. 348.6 180.4

340.6 344. 350.6 181.4

342.6 346. 352.6 182.4

344.6 348. 354.6 183.4

346.6 350. 356.6 184.4

348.6 352. 358.6 185.4

350.6 354. 360.6 186.4

352.6 356. 362.6 187.4

354.6 358. 364.6 188.4

356.6 360. 366.6 189.4

358.6 362. 368.6 190.4

360.6 364. 370.6 191.4

362.6 366. 372.6 192.4

364.6 368. 374.6 193.4

366.6 370. 376.6 194.4

368.6 372. 378.6 195.4

370.6 374. 380.6 196.4

372.6 376. 382.6 197.4

374.6 378. 384.6 198.4

376.6 380. 386.6 199.4

378.6 382. 388.6 200.4

380.6 384. 390.6 201.4

382.6 386. 392.6 202.4

384.6 388. 394.6 203.4

386.6 390. 396.6 204.4

388.6 392. 398.6 205.4

390.6 394. 400.6 206.4

392.6 396. 402.6 207.4

394.6 398. 404.6 208.4

396.6 400. 406.6 209.4

398.6 402. 408.6 210.4

400.6 404. 410.6 211.4

402.6 406. 412.6 212.4

404.6 408. 414.6 213.4

406.6 410. 416.6 214.4

408.6 412. 418.6 215.4

410.6 414. 420.6 216.4

412.6 416. 422.6 217.4

414.6 418. 424.6 218.4

416.6 420. 426.6 219.4

418.6 422. 428.6 220.4

420.6 424. 430.6 221.4

422.6 426. 432.6 222.4

424.6 428. 434.6 223.4

426.6 430. 436.6 224.4

428.6 432. 438.6 225.4

430.6 434. 440.6 226.4

432.6 436. 442.6 227.4

434.6 438. 444.6 228.4

436.6 440. 446.6 229.4

438.6 442. 448.6 230.4

440.6 444. 450.6 231.4

442.6 446. 452.6 232.4

444.6 448. 454.6 233.4

446.6 450. 456.6 234.4

448.6 452. 458.6 235.4

450.6 454. 460.6 236.4

452.6 456. 462.6 237.4

454.6 458. 464.6 238.4

456.6 460. 466.6 239.4

458.6 462. 468.6 240.4

460.6 464. 470.6 241.4

462.6 466. 472.6 242.4

464.6 468. 474.6 243.4

466.6 470. 476.6 244.4

468.6 472. 478.6 245.4

470.6 474. 480.6 246.4

472.6 476. 482.6 247.4

474.6 478. 484.6 248.4

476.6 480. 486.6 249.4

478.6 482. 488.6 250.4

480.6 484. 490.6 251.4

482.6 486. 492.6 252.4

484.6 488. 494.6 253.4

486.6 490

BOARD AND PLANK MEASUREMENT—AT SIGHT

This Table gives the Sq. Ft. and In. in Board from 6 to 25 in. wid., and from 8 to 36 ft. long. If a board be longer than 36 ft., unite two numbers. Thus, if a Board is 40 ft. long, and 16 in. wide, add 30 and 10 and you have 53 ft. 4 in. For 2-in Plank double the product

Feet Long.	6 in W	7 in W	8 in W	9 in W	10 in W	11 in W	12 in W	13 in W	14 in W	15 in W
	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
8	4 0	4 8	5 4	6 0	6 8	7 4	8 0	8 8	9 4	10 0
9	4 6	5 3	6 0	6 9	7 6	8 3	9 0	9 9	10 6	11 3
10	5 0	5 10	6 8	7 6	8 4	9 2	10 0	10 10	11 8	12 6
11	5 6	6 5	7 4	8 3	9 2	10 1	11 0	11 11	12 10	12 9
12	6 0	7 0	8 0	9 0	10 0	11 0	12 0	13 0	14 0	15 0
13	6 6	7 7	8 8	9 9	10 10	11 11	12 12	13 13	14 14	15 15
14	7 0	8 2	9 4	10 6	11 8	12 10	13 12	14 14	15 16	16 18
15	7 6	8 9	10 0	11 2	12 6	13 9	15 0	16 3	17 6	18 9
16	8 0	9 4	10 8	12 0	13 4	14 8	16 0	17 4	18 8	20 0
17	8 6	9 11	11 4	12 9	14 2	15 7	17 0	18 5	19 10	21 3
18	9 0	10 6	12 0	13 6	15 0	16 6	18 0	19 6	21 0	22 6
19	9 6	11 1	12 8	14 3	15 10	17 5	19 0	20 7	22 2	23 9
20	10 0	11 8	13 4	15 0	16 8	18 4	20 0	21 8	23 4	25 0
21	10 6	12 3	14 0	15 9	17 6	19 3	21 0	22 9	24 6	26 3
22	11 0	12 10	14 8	16 6	18 4	20 2	22 0	23 10	25 8	27 6
23	11 6	13 5	15 4	17 3	19 2	21 1	23 0	24 11	26 10	28 9
24	12 0	14 0	16 0	18 0	20 0	22 0	24 0	26 0	28 0	30 0
25	12 6	14 7	16 8	18 9	20 10	22 11	25 0	27 1	29 2	31 3
26	13 0	15 2	17 4	19 6	21 8	23 10	26 0	28 2	30 4	32 6
27	13 6	15 9	18 0	20 3	22 6	24 9	27 0	29 8	31 6	33 9
28	14 0	16 4	18 8	21 0	23 4	25 8	28 0	30 4	32 8	35 0
29	14 6	16 11	19 4	21 9	24 2	26 7	29 0	31 5	33 10	36 3
30	15 0	17 6	20 0	22 6	25 0	27 6	30 0	32 6	35 0	37 6
31	15 6	18 1	20 8	23 3	25 10	28 5	31 0	33 7	36 2	38 9
32	16 0	18 8	21 4	24 0	26 8	29 4	32 0	34 8	37 4	40 0
33	16 6	19 3	22 0	24 9	27 6	30 3	33 0	35 9	38 6	41 3
34	17 0	19 10	22 8	25 6	28 4	31 2	34 0	36 10	39 8	42 6
35	17 6	20 5	23 4	26 3	29 2	32 1	35 0	37 11	40 10	43 9
36	18 0	21 0	24 0	27 0	30 0	33 0	36 0	38 0	42 0	45 0

BOARD TABLE MEASUREMENT—CONTINUED.

Feet Long.	16 in W	17 in W	18 in W	19 in W	20 in W	21 in W	22 in W	23 in W	24 in W	25 in W
	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
8	10 8	11 4	12 0	12 8	13 4	14 0	14 8	15 4	16 0	16 8
9	12 0	12 9	13 6	14 3	15 0	15 9	16 6	17 3	18 0	18 9
10	13 4	14 2	15 0	15 10	16 8	17 6	18 4	19 2	20 0	20 10
11	14 8	15 7	16 6	17 5	18 4	19 3	20 2	21 1	22 0	22 11
12	16 0	17 0	18 0	19 0	20 0	21 0	22 0	23 0	24 0	25 0
13	17 4	18 5	19 6	20 7	21 8	22 9	23 10	24 11	25 12	26 1
14	18 8	19 10	21 0	22 2	23 4	24 6	25 8	26 10	27 12	28 3
15	20 0	21 3	22 6	23 9	25 0	26 3	27 6	28 9	30 0	31 3
16	21 4	22 8	24 0	25 4	26 8	28 0	29 4	30 8	32 0	33 4
17	22 8	24 1	25 6	26 11	28 4	29 9	31 2	32 7	34 0	35 5
18	24 0	25 6	27 0	28 6	30 0	31 6	33 0	34 6	36 0	37 6
19	25 4	26 11	28 6	30 1	31 8	33 3	34 10	36 5	38 0	39 7
20	26 8	28 4	30 0	31 8	33 4	35 0	36 8	38 4	40 0	41 8
21	28 0	29 9	31 6	33 3	35 0	36 9	38 6	40 3	42 0	43 9
22	29 4	31 2	33 0	34 10	36 8	38 6	40 4	42 2	44 0	45 10
23	30 8	32 7	34 6	36 5	38 4	40 3	42 2	44 1	46 0	47 11
24	32 0	34 0	36 0	38 0	40 0	42 0	44 0	46 0	48 0	50 0
25	33 4	35 5	37 6	39 7	41 8	43 9	45 10	47 11	50 0	52 1
26	34 8	36 10	39 0	41 2	43 4	45 6	47 8	49 10	52 0	54 2
27	36 0	38 3	40 6	42 9	45 0	47 3	49 6	51 9	54 0	56 3
28	37 4	39 8	42 0	44 4	46 8	49 0	51 4	53 8	56 0	58 4
29	38 8	41 1	43 6	45 11	48 4	50 9	53 2	55 7	58 0	60 5
30	40 0	42 6	45 0	47 6	50 0	51 6	55 0	57 6	60 0	62 6

SIGHT
from 8 to 36 ft. long
rd is 40 ft long and
double th product

14 in W		15 in W	
ft.	in.	ft.	in.
9	4	10	0
10	6	11	3
11	8	12	6
12	10	12	9
14	0	15	0
15	3	16	3
16	4	17	6
17	6	18	9
18	8	20	0
19	10	21	3
21	0	22	6
22	2	23	9
23	4	24	0
24	6	26	3
25	8	27	6
26	10	28	9
28	0	30	0
29	2	31	3
30	4	32	6
31	6	33	9
32	8	35	0
33	10	36	3
35	0	37	6
36	2	38	9
37	4	40	0
38	6	41	3
39	8	42	6
40	10	43	9
42	0	45	0

UED.

24InW	25InW
ft. in.	ft. in.
16 0	16 8
18 0	18 9
20 0	20 10
22 0	22 11
24 0	25 0
26 0	27 1
28 0	29 2
30 0	31 3
32 0	33 4
34 0	35 5
36 0	37 6
38 0	39 7
40 0	41 8
42 0	43 9
44 0	45 10
46 0	47 11
48 0	50 0
5 0	52 1
52 0	54 2
54 0	56 3
56 0	58 4
58 0	60 5
60 0	62 6

16 0	16 8
18 0	18 9
20 0	20 10
22 0	22 11
24 0	25 0
26 0	27 1
28 6	29 2
30 0	31 3
32 0	33 4
34 0	35 5
36 0	37 6
38 0	39 7
40 3	41 8
42 0	43 9
44 0	45 10
46 0	47 11
48 0	50 0
50 0	52 1
52 0	54 2
54 0	56 3
56 0	58 4
58 0	60 5
60 0	62 6

	D.	D.	D.	D.	D.	D.	D.	D.	D.	D.	D.	D.
100	25	26	27	28	29	30	31	32	33	34	35	36
10	283	309	339	370	377	407	440	456	486	496	513	573
11	311	340	371	395	415	447	484	502	535	546	568	630
12	340	371	405	432	453	489	528	548	581	596	623	688
13	369	404	442	470	491	531	572	594	633	646	708	746
14	397	435	476	505	529	571	618	640	682	696	762	803
15	426	465	511	541	567	612	662	686	731	746	817	861
16	455	495	545	575	605	653	706	732	780	796	872	919
17	483	527	579	614	643	694	751	778	829	846	927	976
18	512	558	613	650	681	735	795	824	878	896	981	1034
19	541	590	647	685	719	776	839	870	927	946	1033	1092
20	569	621	681	724	757	817	884	916	976	996	1091	1148
21	598	652	716	760	793	859	928	962	1025	1046	1146	1206
22	627	684	750	796	834	900	972	1008	1074	1096	1200	1264
23	655	715	784	833	872	941	1017	1054	1123	1146	1255	1318
24	684	746	818	869	910	982	1061	1100	1172	1195	1310	1376
25	713	777	853	905	948	1023	1105	1146	1221	1245	1365	1434
26	742	808	887	941	986	1064	1149	1192	1270	1296	1420	1492
27	771	839	921	977	1024	1105	1193	1238	1319	1346	1475	1550
28	800	870	955	1015	1062	1146	1237	1284	1368	1396	1530	1608
29	829	901	989	1051	1100	1187	1281	1330	1417	1447	1585	1666
30	858	933	1023	1085	1135	1228	1325	1375	1466	1497	1640	1724
31	887	963	1057	1120	1172	1269	1369	1420	1515	1546	1695	1782

EQUAL SIDES TIMBER MEASURE.—CAST IRON.

SOLID CONTENTS OF EQUAL SIDES TIMBER.

If the Log is shorter than is contained in the Table, take half or quarter of some length. If longer double some length. The length of the Log is given on the top of the columns, the diameter in the left hand column. To obtain the Cubical Contents of Masts, Spars, Round Logs, &c., subtract one-fourth from the Contents

D.	L. 9	L. 10	L. 11	L. 12	L. 13	L. 14	L. 15	L. 16	L. 17	L. 18	L. 19	L. 20
6	2 3	2 6	2 9	3 0	3 3	3 6	3 9	4 0	4 3	4 6	4 9	5 0
7	3 0	3 4	3 7	4 1	4 5	4 9	5 1	5 5	5 9	6 2	6 6	6 10
8	4 1	4 4	4 10	5 4	5 9	6 2	6 7	7 0	7 5	8 0	8 3	8 8
9	5 2	5 9	6 2	6 9	7 4	7 11	8 6	9 1	9 8	10 3	10 10	11 5
10	6 2	6 10	7 8	8 4	9 0	9 8	10 4	11 0	11 8	12 4	13 0	13 8
11	7 6	8 4	9 3	10 1	10 11	11 9	12 7	13 5	14 3	15 1	15 11	16 9
12	9 0	10 0	11 0	12 0	13 0	14 0	15 0	16 0	17 0	18 0	19 0	20 0
13	10 4	11 7	12 10	14 1	15 3	16 5	17 9	18 9	19 11	21 1	22 3	23 5
14	12 2	13 7	14 11	16 4	17 8	18 11	20 3	21 7	22 11	24 3	25 7	26 11
15	14 2	15 9	17 2	18 9	20 4	21 10	23 5	25 0	26 7	28 2	29 9	31 4
16	16 0	17 10	19 6	21 4	23 1	24 10	26 7	28 4	30 1	31 10	33 7	35 4
17	18 0	20 2	22 2	24 1	26 1	28 1	30 1	32 1	34 1	36 1	38 1	40 1
18	20 3	22 6	24 9	27 0	29 3	31 6	33 9	36 0	38 3	40 6	42 9	45 0
19	22 6	25 0	27 3	30 1	32 7	35 1	37 7	41 1	43 7	46 1	48 7	52 0
20	25 0	27 10	30 3	33 4	36 1	38 10	41 7	44 4	47 2	50 0	52 9	55 9
21	27 3	30 3	33 9	36 9	39 10	42 11	46 0	49 1	52 2	55 3	58 4	61 5
22	30 2	33 6	36 10	40 4	43 8	47 0	50 4	53 8	57 0	60 4	63 8	67 0
23	33 0	36 4	39 8	44 1	47 9	51 5	55 1	58 9	62 5	66 1	69 9	73 5
24	36 0	40 4	44 8	49 0	53 0	56 0	60 0	64 0	68 0	72 0	76 0	80 0
25	39 0	43 8	48 1	52 1	56 5	60 9	65 1	69 5	73 9	78 1	82 5	86 9
26	42 2	46 6	51 1	55 4	60 1	64 5	69 0	73 5	78 0	82 4	86 9	91 3
27	45 5	50 0	54 5	59 0	63 5	68 0	72 5	77 0	81 5	86 0	90 5	95 0
28	49 0	54 0	59 0	64 0	69 0	74 0	79 0	84 0	89 0	94 0	99 0	104 0
29	52 6	58 0	63 6	69 0	74 6	80 2	85 8	91 4	97 0	102 6	108 2	113 8
30	55 9	62 0	68 6	74 6	81 2	87 8	94 4	101 0	107 6	114 2	120 8	127 4

CAST IRON.

WEIGHT OF A FOOT IN LENGTH OF FLAT CAST IRON.

Width of Iron.	Thick, 1-1/4 inch.	Thick, 3-8ths inch.	Thick, 1-2 inch.	Thick, 1-5/8ths inch.	Thick, 3-4ths inch.	Thick, 7-8ths inch.	Thick, 1 inch.
Inches.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.
2	1 56	2 34	3 12	3 90	4 68	5 46	6 25
2 1/2	1 75	2 63	3 51	4 39	5 27	6 15	7 03
3	1 95	2 92	3 90	4 88	5 85	6 83	7 81
3 1/2	2 14	3 22	4 29	5 37	6 44	7 51	8 59
4	2 34	3 51	4 68	5 85	7 03	8 20	9 37
4 1/2	2 52	3 90	5 07	6 34	7 61	8 88	10 15
5	2 73	4 10	5 45	6 83	8 20	9 57	10 93
5 1/2	2 93	4 30	5 85	7 32	8 78	10 25	11 71
6	3 12	4 68	6 25	7 81	9 37	10 93	12 50
6 1/2	3 32	4 97	6 64	8 30	9 96	11 62	13 28
7	3 51	5 27	7 03	8 78	10 54	12 30	14 06
7 1/2	3 71	5 56	7 42	9 27	11 13	12 98	14 84
8	3 90	5 83	7 81	9 76	11 71	13 67	15 62
8 1/2	4 10	6 15	8 20	10 25	12 30	14 35	16 40
9	4 29	6 44	8 59	10 74	12 89	15 03	17 18
9 1/2	4 49	6 73	8 98	11 23	13 48	15 72	17 96
10	4 68	7 03	9 37	11 71	14 06	16 40	18 75

IRON.

ER.

half or quarter
of the Log is
nd column, To
, &c., subtract

TABLES FOR ENGINEERS AND MACHINISTS.

WEIGHT OF ONE FOOT OF FLAT BAR IRON.

If a Bar of Iron be thicker than contained in the Table, add together the weight of two Numbers, or treble the weight of one Number. Wanted the weight of 1 foot of Bar Iron, 2 inches broad and 2 1-4 inches thick. Opposite 4 and under 1 is 13.364, which doubled is 26.728; add the weight of 1-4th (3.341), equal 30.069 lbs.

	L 19	L 20
6	4 9	5 0
2	6 6	6 10
0	9 3	9 8
3	10 10	11 5
4	13 0	13 8
1	15 11	16 9
0	19 0	20 0
1	22 3	23 5
3	25 7	26 11
2	29 9	31 4
0	33 7	35 4
1	38 1	40 1
6	42 9	45 0
1	48 7	52 0
0	52 9	55 9
3	58 4	61 5
4	63 8	67 0
1	69 9	73 5
0	76 0	80 0
1	82 5	86 9
4	89 0	93 8
7	96 8	101 11
10	103 3	108 8
1	112 11	117 9
6	118 9	125 0

IRON.

Thick, the inch.	Thick, 1 Inch
5.46	6.25
6.15	7.03
6.83	7.81
7.51	8.59
8.20	9.37
8.88	10.15
9.57	10.93
10.25	11.71
10.93	12.50
11.62	13.28
12.30	14.06
12.98	14.84
13.67	15.62
14.35	16.40
15.03	17.18
15.72	17.96
16.40	18.75

THICKNESS IN PARTS OF AN INCH.

breadth in Inches.	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{7}{8}$	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	1 in.
1	.835	1.044	1.253	1.461	1.670	2.088	2.506	2.923	3.340
1 1/4	.939	1.174	1.409	1.644	1.878	2.348	2.818	3.287	3.755
1 1/2	1.044	1.305	1.566	1.826	2.088	2.609	3.132	3.653	4.176
1 3/4	1.148	1.485	1.722	2.009	2.296	2.870	3.444	4.018	4.592
2	1.252	1.566	1.879	2.192	2.504	3.131	3.758	4.384	5.008
2 1/4	1.358	1.696	2.035	2.374	2.716	3.392	4.070	4.749	5.423
2 1/2	1.462	1.827	2.192	2.557	2.924	3.653	4.384	5.114	5.848
2 3/4	1.566	1.957	2.348	2.740	3.132	3.914	4.696	5.479	6.264
3	1.671	2.088	2.505	2.922	3.342	4.175	5.010	5.845	6.684
3 1/4	1.775	2.218	2.662	3.105	3.550	4.435	5.324	6.210	7.100
3 1/2	1.880	2.348	2.818	3.288	3.760	4.696	5.636	6.575	7.520
3 3/4	1.984	2.479	2.975	3.470	3.968	4.957	5.950	6.941	7.936
4	2.088	2.609	3.131	3.653	4.176	5.218	6.262	7.306	8.352
4 1/4	2.193	2.740	3.288	3.836	4.386	5.479	6.576	7.671	8.772
4 1/2	2.297	2.870	3.444	4.018	4.594	5.740	6.888	8.036	9.188
4 3/4	2.402	3.001	3.557	4.201	4.804	6.001	7.202	8.402	9.608
5	2.506	3.131	3.755	4.384	5.012	6.262	7.516	8.767	10.024
5 1/4	2.715	3.392	4.071	4.749	5.430	6.784	8.142	9.498	10.860
5 1/2	2.923	3.653	4.384	5.114	5.816	7.306	8.768	10.228	11.692
5 3/4	3.132	3.914	4.697	5.479	6.264	7.828	9.394	10.959	12.528
6	3.341	4.175	5.010	5.845	6.682	8.360	10.020	11.690	13.364
6 1/4	3.549	4.436	5.323	6.210	7.098	8.871	10.646	12.421	14.196
6 1/2	3.758	4.697	5.636	6.575	7.518	9.336	11.272	13.151	15.032
6 3/4	3.968	4.958	5.949	6.941	7.932	9.915	11.898	13.881	15.864
7	4.175	5.219	6.262	7.306	8.350	10.437	12.526	14.612	16.700
7 1/4	4.384	5.479	6.573	7.671	8.768	10.955	13.152	15.343	17.536
7 1/2	4.593	5.741	6.889	8.037	9.186	11.480	13.778	16.073	18.372
7 3/4	4.801	6.001	7.202	8.403	9.602	12.002	14.404	16.804	19.204
8	5.010	6.262	7.515	8.767	10.020	12.524	15.030	17.535	20.042

WEIGHT OF ONE SQUARE FOOT OF SHEET IRON, &c.

Names	Thickness by the Birmingham Wire Gauge													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Iron.	12.50	12.00	11.00	10.00	8.74	8.12	7.50	6.86	6.24	5.62	5.00	4.38	3.75	3.12
Cop.	14.50	13.90	12.75	11.60	10.10	9.40	8.70	7.90	7.20	6.50	5.80	5.08	4.34	3.60
Brass	13.75	13.20	12.10	11.90	9.61	8.93	8.25	7.54	6.86	6.18	5.50	4.81	4.12	3.43

Thickness by the Wire Gauge													
	15	16	17	18	19	20	21	22	23	24	25	26	27
Iron.	2.82	2.50	2.18	1.86	1.70	1.54	1.40	1.25	1.12	1.00	.90	.80	.72
Cop.	3.27	2.90	2.53	2.15	1.97	1.78	1.62	1.45	1.30	1.16	1.04	.92	.83
Brass	3.10	2.75	2.40	2.04	1.87	1.69	1.54	1.37	1.23	1.10	.99	.88	.79

No. 1 Wire Gauge is 5-16ths of an inch; No. 4 is 1-4th; No. 11 is 1-8th; No. 13 is 1-12th; No. 15 is 1-14th; No. 16 is 1-16th; No. 17 is 1-18th; No. 19 is 1-20; No. 22 is 1-32.

WEIGHT OF BAR IRON AND OTHER METALS.

RUSSIA SHEET IRON

Measures 56 by 23 inches, and is rated by the weight per sheet. The numbers run from 8 to 18 Russian lbs. per sheet. 8 Russian pounds equal 7.2 English pounds; 9=8.1 lbs.; 10=9 lbs.; 11=10 lbs.; 12=11.2 lbs., &c.—100 Russian lbs. equal 90 lbs. English.

WEIGHT OF ONE SQUARE FOOT OF PLATE IRON, &c.

Thickness in parts of an inch.	Iron.	Copper.	Brass.	Lead.	Thickness in parts of an inch.	Iron.	Copper.	Brass.	Lead.
$\frac{1}{16}$	2.5	2.9	2.7	3.7	$\frac{1}{8}$	17.5	20.8	19.0	25.9
$\frac{1}{8}$	5.0	5.8	5.5	7.4	$\frac{3}{8}$	20.0	23.2	21.8	29.6
$\frac{3}{8}$	7.5	8.7	8.2	11.1	$\frac{1}{2}$	25.0	28.9	27.1	37.0
$\frac{1}{2}$	10.0	11.6	10.9	14.8	$\frac{5}{8}$	30.0	34.7	32.5	44.4
$\frac{5}{8}$	12.5	14.5	13.6	18.5	$\frac{3}{4}$	35.0	40.4	37.9	57.8
$\frac{3}{4}$	15.0	17.4	16.3	22.2	1	40.0	46.2	43.3	69.2

WEIGHT ONE FOOT IN LENGTH OF SQUARE AND ROUND BAR IRON

Side and diameter in inches.	Square Iron in lbs.	Round Iron in lbs.	Side and diameter in inches.	Square Iron in lbs.	Round Iron in lbs.	Side and diameter in inches.	Square Iron in lbs.	Round Iron in lbs.
$\frac{1}{4}$	.209	.164	$1\frac{1}{4}$	8.820	6.928	$3\frac{1}{4}$	46.909	36.895
$\frac{1}{8}$	.326	.256	$1\frac{1}{2}$	10.229	8.043	$3\frac{1}{2}$	50.153	39.330
$\frac{3}{8}$	.470	.369	$1\frac{3}{4}$	11.744	9.224	4	53.440	41.934
$\frac{1}{2}$	.640	.503	2	13.360	10.496	$4\frac{1}{4}$	56.833	44.637
$\frac{5}{8}$	.835	.656	$2\frac{1}{4}$	15.083	11.846	$4\frac{1}{2}$	60.329	47.335
$\frac{3}{4}$	1.057	.831	$2\frac{1}{2}$	16.909	13.283	$4\frac{3}{4}$	63.930	50.211
$\frac{7}{8}$	1.305	1.025	$2\frac{3}{4}$	18.840	14.797	5	67.637	53.132
$1\frac{1}{8}$	1.579	1.241	3	20.875	16.396	$5\frac{1}{4}$	71.445	56.113
$1\frac{1}{4}$	1.879	1.476	$3\frac{1}{4}$	23.115	18.146	$5\frac{1}{2}$	75.359	59.187
$1\frac{3}{8}$	2.205	1.732	$3\frac{1}{2}$	25.259	19.842	$5\frac{3}{4}$	79.378	62.344
$1\frac{1}{2}$	2.558	2.011	$3\frac{3}{4}$	27.608	21.684	6	83.510	65.585
$1\frac{3}{4}$	2.936	2.306	4	30.070	23.653	$6\frac{1}{4}$	92.459	72.618
1	3.340	2.624	$4\frac{1}{4}$	32.618	25.620	$6\frac{1}{2}$	101.086	79.870
$1\frac{1}{8}$	4.228	3.321	$4\frac{1}{2}$	35.279	27.709	$6\frac{3}{4}$	110.429	86.731
$1\frac{1}{4}$	5.219	4.099	$4\frac{3}{4}$	38.045	29.881	7	120.243	94.610
$1\frac{3}{8}$	6.315	4.961	5	40.916	32.170	The weight of Bar Iron being: " " " Cast Iron = 36 " " " Steel, 138 " " " Copper, 139		
$1\frac{1}{2}$	7.516	5.918	$5\frac{1}{4}$	43.890	34.472			

METALS.

WEIGHT OF ROUND AND SQUARE CAST IRON.

sheet. The num-
pounds equal 7.2
2=11.2 lbs., &c.-

CAST IRON.—Weight of a Foot in Length of Square and Round.

IRON, &c.

Copper.	Brass.	Lead.
20.3	19.0	25.9
23.2	21.8	29.6
28.9	27.1	37.0
34.7	32.5	44.4
40.4	37.9	57.8
46.2	43.3	59.2

SQUARE.				ROUND			
Size.	Weight.	Size	Weight.	Size.	Weight.	Size.	Weight.
Inches Square.	Pounds.	Inches Square.	Pounds.	Inches Diam.	Pounds.	Inches Diam.	Pounds
	.78	4½	74.26		.61	4½	68.32
	1.22	5	78.12		.95	5	61.35
	1.75	5½	82.08		1.38	5½	34.46
	2.39	6	86.13		1.87	6	37.61
1	3.12	6½	90.28	1	2.45	6½	30.09
1½	3.95	7	94.53	1½	3.10	7	34.24
1½	4.88	7½	98.87	1½	3.83	7½	37.65
1½	5.90	8	103.32	1½	4.61	8	41.14
1½	7.03	8½	107.86	1½	5.52	8½	44.71
1½	8.25	9	112.50	1½	6.48	9	48.35
1½	9.67	9½	122.08	1½	7.51	9½	52.07
1½	10.98	10	132.03	1½	8.62	10	55.89
2	12.50	10½	142.38	2	9.81	10½	59.82
2	14.11	11	153.12	2	11.08	11	63.85
2	15.81	11½	164.25	2	12.42	11½	67.99
2	17.62	12	175.78	2	13.84	12	72.24
2	19.53	12½	187.68	2	15.33	12½	76.60
2	21.53	13	200.12	2	16.91	13	81.07
2	23.68	13½	212.56	2	18.56	13½	85.65
2	25.83	14	225.78	2	20.28	14	90.34
3	28.12	14½	239.25	3	22.18	14½	95.14
3	30.61	15	253.12	3	23.96	15	100.05
3	33.	15½	267.38	3	25.92	15½	105.07
3	35.59	16	282.	3	27.95	16	110.20
3	38.28	16½	297.07	3	30.16	16½	115.43
3	41.06	17	312.50	3	32.25	17	120.77
3	43.94	17½	328.52	3	34.51	17½	126.21
3	46.92	18	344.83	3	36.85	18	131.75
4	50.	18½	361.13	4	39.27	18½	137.40
4	53.14	19	378.12	4	41.76	19	143.15
4	56.44	19½	395.50	4	44.27	19½	149.00
4	59.81	20	413.78	4	46.97	20	154.95
4	63.28	20½	431.44	4	49.70	20½	161.00
4	66.84	21	450.	4	52.50	21	167.15
4	70.50			4	55.37		

IRON AND ROUND

Square Iron. in lbs.	Round Iron in lbs.
40.909	36.896
50.153	39.390
58.440	41.934
56.833	44.637
60.329	47.388
63.930	50.211
67.637	53.132
71.445	56.113
75.359	59.187
79.378	62.344
83.510	65.588
92.459	72.618
101.086	79.870
110.429	86.731
120.243	94.610

weight of bar iron being
" " Cast Iron = 36
" " Steel, 100
" " Copper, 118

STEEL.—Weight of a Foot in Length of Flat.

Size.	Thick, 1-4 in.	Thick, 3-8ths.	Thick, 1-2 in.	Thick, 5-8ths.	Side.	Thick, 1-4 in.	Thick, 3-8ths.	Thick, 1-2 in.	Thick, 5-8ths.
In.	Pds.	Pds.	Pds.	Pds.	In.	Pds.	Pds.	Pds.	Pds.
1	.852	1.27	1.70	2.13	2½	2.13	3.20	4.26	5.32
1½	.958	1.43	1.91	2.39	2½	2.34	3.51	4.68	5.85
1½	1.06	1.59	2.13	2.66	3	2.55	3.83	5.11	6.39
1½	1.17	1.75	2.34	2.92	3½	2.77	4.15	5.53	6.92
1½	1.27	1.91	2.55	3.19	3½	2.93	4.47	5.98	7.45
1½	1.49	2.23	2.98	3.72	3½	3.19	4.79	6.38	7.98
2	1.70	2.55	3.40	4.26	4	3.40	5.10	6.80	8.52
2½	1.91	2.87	3.83	4.79					

WEIGHT OF METALS.

PATENT IMPROVED LEAD PIPE.—*Sizes and Weight per Foot.*

Calibre.	Weight per foot.	Calibre.	Weight per foot.	Calibre.	Weight per foot.	Calibre.	Weight per foot.	Calibre.	Weight per foot.
Inches.	Lbs. ozs.	Inches.	Lbs. ozs.	Inches.	Lbs. ozs.	Inches.	Lbs. ozs.	Inches.	Lbs. ozs.
$\frac{1}{2}$	6	$\frac{1}{4}$	4	$\frac{3}{4}$	4	1	4 0	$1\frac{1}{2}$	5 0
"	8	"	8	"	2 0	"	6 0	$1\frac{3}{4}$	4 0
"	10	"	2 0	"	2 4	$1\frac{1}{2}$	2 8	2	5 0
"	12	"	3 0	"	2 8	"	3 0	"	6 0
"	1 0	"	13	"	3 0	"	3 8	"	7 0
"	1 8	"	1 0	"	4 0	"	4 0	$2\frac{1}{2}$	11 0
$\frac{3}{4}$	8	"	1 8	1	1 8	"	5 0	$2\frac{3}{4}$	13 0
"	10	"	2 0	"	1 12	$1\frac{1}{2}$	3 0	3	15 0
"	12	"	2 12	"	2 0	"	3 8	$3\frac{1}{2}$	18 0
"	14	$\frac{1}{2}$	12	"	2 8	"	4 0	4	20 0
"	1 0	"	14	"	3 0	"	4 8	5	22 0

SHEET LEAD.—Weight of a Square Foot, $2\frac{1}{2}$, 3, $3\frac{1}{2}$, 4, $4\frac{1}{2}$, 5, 6, 7, $8\frac{1}{2}$, 9, 10 lbs., and upwards.

BRASS, COPPER, STEEL, AND LEAD.—*Weight of a Foot.*

Diameter and Side of Square.	BRASS.		COPPER.		STEEL.		LEAD.	
	Weight of Round.	Weight of Square.	Weight of Round.	Weight of Square.	Weight of Round.	Weight of Square.	Weight of Round.	Weight of Square.
Inches.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
$\frac{1}{8}$	.17	.22	.19	.24	.17	.21		
$\frac{1}{4}$	.39	.50	.42	.54	.38	.48		
$\frac{3}{8}$	.70	.90	.75	.96	.67	.85		
$\frac{1}{2}$	1.10	1.40	1.17	1.50	1.04	1.33		
$\frac{5}{8}$	1.59	2.02	1.69	2.16	1.50	1.91		
$\frac{3}{4}$	2.16	2.75	2.31	2.94	2.05	2.61		
1	2.83	3.60	3.02	3.84	2.67	3.40	3 87	4.93
$1\frac{1}{8}$	3.58	4.56	3.82	4.86	3.38	4.34	4.90	6.25
$1\frac{1}{4}$	4.42	5.63	4.71	6.	4.18	5.32	6.06	7.71
$1\frac{1}{2}$	5.35	6.81	5.71	7.27	5.06	6.44	7.33	9.33
$1\frac{3}{4}$	6.36	8.10	6.79	8.65	6.02	7.67	8.72	11.11
2	7.47	9.51	7.94	10.15	7.07	9	10.24	13.04
$2\frac{1}{8}$	8.66	11.03	9.21	11.77	8.20	10.14	11.87	15.12
$2\frac{1}{4}$	9.95	12.66	10.61	13.52	9.41	11.98	13.63	17.38
$2\frac{1}{2}$	11.32	14.41	12.08	15.38	10.71	13.63	15.51	19.75
$2\frac{3}{4}$	12.78	16.27	13.64	17.36	12.05	15.80	17.51	22.29
3	14.32	18.24	15.29	19.47	13.51	17.20	19.63	25.
$3\frac{1}{8}$	15.98	20.32	17.03	21.60	15.05	19.17	21.80	27.80
$3\frac{1}{4}$	17.68	22.53	18.87	24.03	16.68	21.21	24.24	30.86
$3\frac{1}{2}$	19.50	24.83	20.81	26.50	18.39	23.41	26.72	34.02
$3\frac{3}{4}$	21.40	27.25	22.84	29.08	20.18	25.70	29.33	37.34
4	23.39	29.78	24.92	31.79	22.06	28.10	32.05	40.81
$4\frac{1}{8}$	25.47	32.43	27.18	34.61	24.23	30.60	34.90	44.44

CAST IRON.—*Weight of a Superficial Foot from $\frac{1}{4}$ to 2 inches thick.*

Size.	Weight	Size.	Weight	Size.	Weight	Size.	Weight	Size.	Weight
Ins.	Pounds.	Ins.	Pounds.	Ins.	Pounds.	Ins.	Pounds.	Ins.	Pounds.
$\frac{1}{4}$	9.37	$\frac{1}{2}$	23.43	1	37.50	$1\frac{1}{2}$	51.56	$1\frac{3}{4}$	65.62
$\frac{3}{8}$	14.06	$\frac{3}{4}$	28.12	$1\frac{1}{4}$	42.18	1	56.25	$1\frac{1}{2}$	70.31
$\frac{1}{2}$	18.75	1	32.81	$1\frac{1}{2}$	46.87	$1\frac{3}{4}$	60.93	2	75.

CAST IRON COLUMNS. MOLDER'S TABLE.

DIMENSIONS OF CYLINDRICAL COLUMNS OF CAST IRON TO SUSTAIN A PRESSURE WITH SAFETY.

Weight per Foot.

ht in ft.	Calibre.	Weight per foot.
0	Inches.	lbs. oz.
0	1	5 0
0	1 1/2	4 0
8	2	5 0
0	"	6 0
0	"	7 0
0	2 1/2	11 0
0	3	13 0
0	3 1/2	15 0
8	4	18 0
0	4 1/2	20 0
8	5	22 0

4, 4 1/2, 5, 6, 7, 8, 9.

Weight of a Foot.

ht in ft.	Weight of Round.	Weight of Square.
0	Lbs.	Lbs.
21	3 87	4 93
48	4 90	6 25
85	6 06	7 71
33	7 53	9 33
91	8 72	11 11
61	10 24	13 04
40	11 87	15 12
34	13 63	17 36
32	15 51	19 75
44	17 51	22 29
57	19 63	25 00
74	21 80	27 80
98	24 24	30 86
131	26 72	34 02
160	29 33	37 34
190	32 05	40 81
220	34 90	44 44

to 2 inches thick.

ht in ft.	Size.	Weight
0	Inch.	Pounds.
56	1 1/2	65 62
25	1 1/2	70 31
93	2	76 00

Diameter in inches.	LENGTH OR HEIGHT IN FEET.										
	4	6	8	10	12	14	16	18	20	22	24
	WEIGHT OR LOAD IN CWTs.										
2	72	60	49	40	32	26	22	18	15	13	11
2 1/2	119	105	91	77	65	55	47	40	34	29	25
3	178	163	145	128	111	97	84	73	64	56	49
3 1/2	247	232	214	191	172	156	135	119	106	94	83
4	326	310	288	266	242	220	198	178	160	144	130
4 1/2	418	400	379	354	327	301	275	251	229	208	189
5	522	501	479	452	427	394	365	337	310	285	262
6	607	592	573	550	525	497	469	440	413	386	360
7	1032	1013	989	959	924	887	848	808	765	725	686
8	1333	1315	1289	1259	1224	1185	1142	1097	1052	1005	959
9	1716	1697	1672	1640	1608	1561	1515	1467	1416	1364	1311
10	2119	2100	2077	2045	2007	1964	1916	1865	1811	1755	1697
11	2570	2550	2520	2490	2450	2410	2358	2305	2248	2189	2127
12	3050	3040	3020	2970	2930	2900	2839	2780	2730	2670	2610

Practical utility of the Table.

Note.—Wanting to support the front of a building with cast iron columns 15 feet in length, 8 inches in diameter, and the metal 1 inch in thickness; what weight may I confidently expect each column capable of supporting without tendency to deflection?

Opposite 8 inches diameter and under 18 feet=1097

* Also opposite 6 in. diam. and under 18 feet= 440

=657 cwt.

* This deduction is on account of the core.

MOLDER'S TABLE.

Bar Iron being 1,			Cast Iron being 1,			Yellow Pine being 1,		
Cast Iron equal	1.95		Bar Iron equal	1.07		Cast Iron equal	12.	
Steel	1.02		Steel	1.08		Brass	12.7	
Copper	1.16		Brass	1.16		Copper	13.3	
Brass	1.09		Copper	1.21		Lead	19.1	
Lead	1.48		Lead	1.56		Zinc	11.5	

1. Suppose I have an article of plate iron, the weight of which is 728 lbs., but want the same of copper, and of similar dimensions, what will be its weight?

$$728 \times 1.16 = 844.48 \text{ lbs.}$$

2. A model of Dry Pine weighing 3 lbs., and in which the iron for its construction forms no material portion of the weight, what may I anticipate its weight to be in cast iron.

$$3 \times 12 = 36 \text{ pounds.}$$

It frequently occurs, in the construction of models, that neither the quality or condition of the wood can be properly estimated; and in such cases, it may be a near enough approximation to reckon 13 lbs. of cast iron to each pound of model.

WOOD AND BARK MEASUREMENT—AT SIGHT.

This table is calculated for *Wood 4 feet in length*. If the wood be 8 feet long double the products; if 12 treble, and so on. If the wood should be only 3 feet in length, then deduct from the products $\frac{1}{2}$; if $\frac{3}{4}$ deduct 1-8. Fractions of a solid foot less than $\frac{1}{2}$ are not counted; $\frac{1}{2}$ half foot and over is counted as 1 foot.

The Rule for Measuring Wood is, if in feet only, to multiply the length by the width, and that product by the height, and divide the last product, if for feet, by 128, and if for Cords, by 128. But if any of the dimensions be in feet and inches, reduce the whole to inches and multiply as above, then divide the product by 1728 in order to obtain cubic feet, and then divide the quotient by 128 to obtain cords.

Hgt.	Width 2 ft and			Width 3 ft and			Width 4 ft and			Width 5 ft and			Width 6 ft and			Width 7 ft and			Width 8 ft and			Width 9 ft and			Width 10 ft and			Width 11 ft and			Width 12 ft and			Width 13 ft and			Width 14 ft and			Width 15 ft and			Width 16 ft and			Width 17 ft and			Width 18 ft and			Width 19 ft and			Width 20 ft and			Width 21 ft and			Width 22 ft and			Width 23 ft and			Width 24 ft and			Width 25 ft and			Width 26 ft and			Width 27 ft and			Width 28 ft and			Width 29 ft and			Width 30 ft and			Width 31 ft and			Width 32 ft and			Width 33 ft and			Width 34 ft and			Width 35 ft and			Width 36 ft and			Width 37 ft and			Width 38 ft and			Width 39 ft and			Width 40 ft and			Width 41 ft and			Width 42 ft and			Width 43 ft and			Width 44 ft and			Width 45 ft and			Width 46 ft and			Width 47 ft and			Width 48 ft and			Width 49 ft and			Width 50 ft and			Width 51 ft and			Width 52 ft and			Width 53 ft and			Width 54 ft and			Width 55 ft and			Width 56 ft and			Width 57 ft and			Width 58 ft and			Width 59 ft and			Width 60 ft and			Width 61 ft and			Width 62 ft and			Width 63 ft and			Width 64 ft and			Width 65 ft and			Width 66 ft and			Width 67 ft and			Width 68 ft and			Width 69 ft and			Width 70 ft and			Width 71 ft and			Width 72 ft and			Width 73 ft and			Width 74 ft and			Width 75 ft and			Width 76 ft and			Width 77 ft and			Width 78 ft and			Width 79 ft and			Width 80 ft and			Width 81 ft and			Width 82 ft and			Width 83 ft and			Width 84 ft and			Width 85 ft and			Width 86 ft and			Width 87 ft and			Width 88 ft and			Width 89 ft and			Width 90 ft and			Width 91 ft and			Width 92 ft and			Width 93 ft and			Width 94 ft and			Width 95 ft and			Width 96 ft and			Width 97 ft and			Width 98 ft and			Width 99 ft and			Width 100 ft and			Width 101 ft and			Width 102 ft and			Width 103 ft and			Width 104 ft and			Width 105 ft and			Width 106 ft and			Width 107 ft and			Width 108 ft and			Width 109 ft and			Width 110 ft and			Width 111 ft and			Width 112 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and			Width 165 ft and			Width 166 ft and			Width 167 ft and			Width 168 ft and			Width 169 ft and			Width 170 ft and			Width 171 ft and			Width 172 ft and			Width 173 ft and			Width 174 ft and			Width 175 ft and			Width 176 ft and			Width 177 ft and			Width 178 ft and			Width 179 ft and			Width 180 ft and			Width 181 ft and			Width 182 ft and			Width 183 ft and			Width 184 ft and			Width 185 ft and			Width 186 ft and			Width 187 ft and			Width 188 ft and			Width 189 ft and			Width 190 ft and			Width 191 ft and			Width 192 ft and			Width 193 ft and			Width 194 ft and			Width 195 ft and			Width 196 ft and			Width 197 ft and			Width 198 ft and			Width 199 ft and			Width 200 ft and			Width 201 ft and			Width 202 ft and			Width 203 ft and			Width 204 ft and			Width 205 ft and			Width 206 ft and			Width 207 ft and			Width 208 ft and			Width 209 ft and			Width 210 ft and			Width 211 ft and			Width 212 ft and			Width 213 ft and			Width 214 ft and			Width 215 ft and			Width 216 ft and			Width 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VALUE OF WOOD AND BARK.

VALUE OF WOOD AND BARK PER FEET AND CORD.

The price per Cord is found at the top of the column. The Solid Feet are in the left hand column, (under Ft.) opposite which are the prices per foot. 128 cubic feet, or a Cord, or pile, 8 feet long 4 feet wide and 4 feet high, is a cord of wood as established by law in most of the States and the Dominion of Canada. If the price of more than one cord is required, the amount can be readily added or multiplied.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100																																											
2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110	112	114	116	118	120	122	124	126	128	130	132	134	136	138	140	142	144	146	148	150	152	154	156	158	160	162	164	166	168	170	172	174	176	178	180	182	184	186	188	190	192	194	196	198	200																																											
3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63	66	69	72	75	78	81	84	87	90	93	96	99	102	105	108	111	114	117	120	123	126	129	132	135	138	141	144	147	150	153	156	159	162	165	168	171	174	177	180	183	186	189	192	195	198	201	204	207	210	213	216	219	222	225	228	231	234	237	240	243	246	249	252	255	258	261	264	267	270	273	276	279	282	285	288	291	294	297	300																																											
4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84	88	92	96	100	104	108	112	116	120	124	128	132	136	140	144	148	152	156	160	164	168	172	176	180	184	188	192	196	200	204	208	212	216	220	224	228	232	236	240	244	248	252	256	260	264	268	272	276	280	284	288	292	296	300	304	308	312	316	320	324	328	332	336	340	344	348	352	356	360	364	368	372	376	380	384	388	392	396	400																																											
5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235	240	245	250	255	260	265	270	275	280	285	290	295	300	305	310	315	320	325	330	335	340	345	350	355	360	365	370	375	380	385	390	395	400	405	410	415	420	425	430	435	440	445	450	455	460	465	470	475	480	485	490	495	500																																											
6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126	132	138	144	150	156	162	168	174	180	186	192	198	204	210	216	222	228	234	240	246	252	258	264	270	276	282	288	294	300	306	312	318	324	330	336	342	348	354	360	366	372	378	384	390	396	402	408	414	420	426	432	438	444	450	456	462	468	474	480	486	492	498	504	510	516	522	528	534	540	546	552	558	564	570	576	582	588	594	600																																											
7	14	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140	147	154	161	168	175	182	189	196	203	210	217	224	231	238	245	252	259	266	273	280	287	294	301	308	315	322	329	336	343	350	357	364	371	378	385	392	399	406	413	420	427	434	441	448	455	462	469	476	483	490	497	504	511	518	525	532	539	546	553	560	567	574	581	588	595	602	609	616	623	630	637	644	651	658	665	672	679	686	693	700	707	714	721	728	735	742	749	756	763	770	777	784	791	798	805	812	819	826	833	840	847	854	861	868	875	882	889	896	903	910	917	924	931	938	945	952	959	966	973	980	987	994	1001
8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168	176	184	192	200	208	216	224	232	240	248	256	264	272	280	288	296	304	312	320	328	336	344	352	360	368	376	384	392	400	408	416	424	432	440	448	456	464	472	480	488	496	504	512	520	528	536	544	552	560	568	576	584	592	600	608	616	624	632	640	648	656	664	672	680	688	696	704	712	720	728	736	744	752	760	768	776	784	792	800	808	816	824	832	840	848	856	864	872	880	888	896	904	912	920	928	936	944	952	960	968	976	984	992	1000																		

CISTERN—SCREWS—CUBIC OR SOLID MEASURE.

CAPACITY OF CISTERNS AND RESERVOIRS IN GALLONS.

Depth, 10 Inches :— Diameter from 2 to 25 Feet.

2	feet	19.5	5	feet	122.40	8	feet	313.33	12	feet	705.
2½	"	39.6	5½	"	148.10	8½	"	333.72	13	"	827.4
3	"	44.06	6	"	176.25	9	"	396.56	14	"	959.6
3½	"	59.97	6½	"	206.85	9½	"	461.40	15	"	1101.6
4	"	78.33	7	"	239.88	10	"	489.20	20	"	1958.4
4½	"	99.14	7½	"	275.40	11	"	592.40	25	"	3069.9

NUMBER OF THREADS IN V-TREAL SCREWS.

Diam. in inches.....	½	⅝	¾	7⁄8	1	1 1⁄8	1 ¼	1 ½	1 ¾	2
No. of threads.....	20	18	16	14	12	11	10	9	8	7
Diam. in inches.....	1 1⁄8	1 ¼	1 ½	1 ¾	2	2 1⁄8	2 ¼	2 ½	3	3 1⁄8
No. of threads.....	6	5	4	3	2	1	1	1	1	1
D. m. in inches.....	3 3⁄8	4	4 1⁄8	4 1⁄4	4 1⁄2	5	5 1⁄8	5 1⁄4	5 1⁄2	6
No. of threads.....	8	8	2 1⁄2	2 1⁄4	2 1⁄2	2 1⁄4	2 1⁄2	2 1⁄4	2 1⁄2	2 1⁄4

The depth of the threads should be half their pitch. The diameter of a screw, to work in the teeth of a wheel, should be such, that the angle of the threads does not exceed 10°

CUBIC, OR SOLID MEASURE.

To find the Cubical Content in a *Stick of Timber, Block of Stone, Box, Bin, &c.* If all the Dimensions are in Feet, multiply the Length by the Breadth, and this product by the Depth to obtain the number of Cubic Feet.

If the Length is in Feet and the width and depth in inches, multiply the length by the width and this Product by the depth in inches,—then divide the last Product by 144 for the Cubic Feet. If all the Dimensions are in Feet and Inches reduce the whole to Inches, then multiply the Length, Breadth and Depth together, and divide the Product by 1728 to obtain the Cubic Feet.

Required the number of cubic feet in a *box, stone, &c.*, 4½ feet long, 2½ feet wide and 2 feet deep?

$$4.5 \times 2.5 \times 2 = 22\frac{1}{2} \text{ cubic feet.}$$

To find the capacity of a *bin, cistern, tanner's vat, &c.*, find its (interior) cubic contents in *inches*, by the preceding rules, then if the capacity be required in *gallons*, divide the whole number of inches by 231;—if in bushels, by 2150.42,—or, if in heaped bushels, by 2747.70.

Or, if the interior of a *coal bin* be 4 feet in length, 41 inches in breadth, and 32 inches in depth; then,

$$4 \times 41 \times 32 \times .00034 = 36\frac{1}{2} \text{ cubic feet.} = 2000 \text{ lbs., or 1 ton of Beaver Meadow or Lehigh Coal.}$$

1 Cubic Foot of Peach Mountain Coal, broken or screened for Stoves, weighs 64 pounds, and requires 37 cubic feet of space to stow one ton of 2000 pounds.

Coal is bought at wholesale at the rate of 2240 pounds to the ton, and sold at retail at the rate of 2000 pounds to the ton, *screened*.

Or, if the interior of a *crib* be 6½ feet in length, 3½ feet in breadth, and 3½ feet in depth; then,

$$6.5 \times 3.5 \times 3.5 \times .80356 = 63.6522 \text{ (or } 63\frac{1}{2} \text{ bushels and } \frac{1}{2} \text{ peck.)}$$

The Solid Contents of all bodies, which are of uniform bigness throughout, whatever may be the form of the ends is found by multiplying the area of one end into its height or length.

$$144 \text{ inches equal (=) 1 square foot, (or, area.)}$$

$$1728 \text{ inches equal (=) 1 cubic foot, (or, solid contents.)}$$

SURE.

ALLONS.

feet 705.
 " 827 4
 " 959 6
 " 1101 6
 " 1953 4
 " 3050 9

EWS.

1 1/2	1 1/2	1 1/2
7	7	6
3	3 1/2	3 1/2
3 1/2	3 1/2	3 1/2
5 1/2	5 1/2	6
2 1/2	3 1/2	2 1/2

e diameter of a
 at the angle of

of Stone, Box,
 Length by the
 number of Cubic

es, multiply the
 es.—then divide
 mensons are in
 ply the Length,
 28 to obtain the

, 4 1/2 feet long, 2 1/2

find its (interior)
 the capacity be
 by 231;—if in

ches in breadth,

ton of Beaver

ened for Stoves,
 stow one ton of

to the ton, and
 ed.
 in breadth, and

and 1 peck.)
 bigness through-
 multiplying the

contents.]

APPENDIX TO "THE ARTIZAN'S GUIDE." ON CORRESPONDENCES.

By reference to page 265 it will be seen that something was stated regarding correspondences, together with an allusion to the appendix for farther information. The amplitude of the subject being very great, no more can be promised here than a very abridged statement by way of illustration. Not being aware that the subject has ever been alluded to in connection with a work of this kind, perhaps some will be inclined to attach a certain amount of blame on account of introducing it here, as there is *apparently* but very slight relationship between the subjects treated of throughout this work and the topic under consideration. But inasmuch as it is believed that its consideration will fulfil a much needed use and command the approbation of all good men, the censure of others is but little regarded in comparison. Furthermore, the discrepancy is only apparent, for many things mentioned in this book, together with thousands of other things, will be comprehended just in proportion as correspondences are understood; consequently any effort that tends to dissipate the obscurity, and enlighten the darkness, with which, as regards this subject, many minds are beclouded, must be productive of good, while the knowledge in question will enable us to account for many of the phenomena of the visible creation, such as chemical affinities, the constitution and qualities of different kinds of metal, and their action on each other, besides suggesting innumerable instructive thoughts on other interesting questions of a purely natural kind: nevertheless the writer desires to state that his motive for considering the subject in this place, is a desire to give a few examples of the working of the principle as an unerring rule in unfolding the true meaning of the Sacred writings, for strange as the assertion may appear to many, the meaning of the Divine Word as to its true or internal sense, can be evolved in no other way. It should be known that the Word being Divine, is composed in a manner different from all other writings whatsoever, being written by pure correspondences, for which reason, through the use of emblems, symbols, types, and representatives, it contains and embraces within its bosom things which regard the Lord, his heaven, the Church, man, and the things of love and faith, even when such subjects do not in the least appear in the letter while it is being read, for it is a Divine truth, that there are indefinite things in each expression of the Word, which appears to man so simple and rude; yea, there is contained therein more than man can ever comprehend, because it is the embodiment of Infinite wisdom, and is as to its inmosts, the Lord Himself, John i-1, Rev. xix. 13. Treat with the utmost reverence therefore, I pray you, whatever has relation to the Word of GOD, for by so doing you do honour to that SACRED NAME which should never be taken in vain. Of all the abounding iniquities of society, none are more destructive of the germs of goodness implanted by our Heavenly Father in man's heart, and none ministers less gratification to the depraved cravings of fallen man, than the profanation of the NAME and Word of the everblessed GOD. Let every one discountenance this appalling enormity, and beware of it as he would shun eternal ruin, not only on account of its infamous character as a sin against GOD, but also out of common regard for the feelings of our neighbours.

The science of correspondences unfolds those spiritual laws in accordance with which the word of God is written. The word *correspondence* is derived from the Latin terms *con* and *respondeo*, and means, radically, to answer with or to agree. It will serve our purpose here to define it as the appearance of the internal in the external, and its representation there; in other words, internal and spiritual things are mirrored forth and represented in external and natural forms. The Word throughout, is written with a constant reference to an exact and immutable relation between spiritual and natural things. Various descriptions are there given of the

sun, moon, and stars; of the earth with her mountains, valleys and rivers; of men, animals and plants, gold and silver, brass and iron, and a thousand other things which appear in the natural world. In all these descriptions there is a constant reference to the internal and spiritual causes from which these things exist, and to which they correspond. The Word, in its literal sense, is thus wrought together with infinite skill, constituting a permanent receptacle of divine and spiritual things. Within are the living principles, the *spirit and life* of the Word, of which it is said, "The words I speak unto you, they are *spirit* and they are *life*" John vi. 63. The science of correspondences is to the Word of God what the mathematical science is to the phenomena of the material universe. It reveals order, harmony, beauty and Divine perfection in the midst of what seemed to be disorder, uncertainty, inextricable confusion and even contradiction. It is a most melancholy spectacle at this day to see professed expounders of the Word tell their hearers that the Bible is full of errors, that such and such passages contradict each other, and then proceed forthwith to communicate a vast amount of erudite self-derived intelligence in the shape of glosses, comments and explanations, with the only effect of causing real confusion where there never was any, whilst a knowledge of this heavenly science, for such indeed it is, would have enabled them to harmonize all apparent discrepancies at once.

Not so were the men of the most Ancient Church described in those Divinely composed allegories in the beginning of Genesis, previous to that awful apostacy and declension from goodness described under the representation of a flood which swept over the whole earth. They were gifted with such an intuitive knowledge from above, that they could as it were, read God's word in His Works, and learn and think of heavenly things through and by means of the contemplation of corresponding earthly things. For example, when with the natural eye they beheld a mountain, instantly the emotions of their minds would assume a corresponding elevation toward the Lord, for by a mountain in the most Ancient Church was signified the Lord, and all that is celestial from Him, as the good of love and charity; the most ancient people, and all the ancients, even the Gentiles, worshipped on mountains from this origin. Hence it is written, "I will lift up mine eyes to the *mountains* (or hills), from whence cometh my help, my help cometh from the Lord, which made heaven and earth," Ps. cxxi. We may see from this the true reason why the blessed REDEEMER taught the people from mountains, ascended up into high mountains, and abode in mountains to such an extent as is recorded of Him in the gospels. For the sake of farther illustration it may be proper in this place to adduce a harmony of passages where mountains are mentioned, together with the internal sense signified by them. All the high *mountains* covered with the waters of the flood (Gen. vii. 19.) denotes that all the goods of charity were extinguished by falses and persuasions of the false, or what is the same, overflowing wickedness. The ark of Noah resting upon the *mountains* of Ararat, (Gen. viii. 4, 5) denotes the first light after temptation, which is from charity. The children of Shem dwelling from Mesha, as thou goest unto Sephar, a *mount* of the east, (Gen. x. 30.) denotes worship from the truths of faith extending to the good of charity as its end. Abraham's removal unto a *mountain* on the east of Bethel (Gen. xii. 8), denotes the progression of celestial love with which the Lord was imbued in infancy, for by Abraham in the word is represented the Lord as to the divine celestial principle, or divine good. They that remained flying to the *mountains* after Abraham's victory in Siddim (Gen. xiv. 10), denotes the love of self and the world against which the Lord fought from his love for the whole human race. Lot said to ascend from Zoar and dwelling in a cave in the *mountain* (Gen. xix. 39) denotes the obscure good of those who are without the truths of faith. Jacob sacrificing a sacrifice in the *mountain* (Gen. xxxi. 64), denotes worship from the good of love. The angel of the Lord appearing to Moses in the *mount* of God (Ex. iii. 2-4), denotes the divine human manifested in the good of love; ye shall serve God upon this *mountain*, said to Moses (Ex. iii. 12), denotes the perception and acknowledgement of the Divine from love. Moses to stand on the top of the *mount* with the rod of God in his hand, during the battle with Amalek, denotes the conjunction of truth divine with the good of charity, and truth in power

from good; Israel prevailing when Moses raised his hand and Amalek prevailing when he let down his hand, denotes that the victory is with those who are in the truth and good of faith when they look upwards to the Lord; but that the false overcomes them when they look down to self and the world, for Amalek represents interior evil. Israel to be planted in the *mountain* of the Lord's inheritance, (Ex. xv. 17.) denotes regeneration, and heaven, from the life of truth and goodness. The Israelites encamped at the *mount* of God (Ex. xviii. 5), denotes the new arrangement of truths when about to be conjoined with good in the second stage of regeneration. The Lord came from Sinai, He shone from *mount* Paran (Deut. xxxiii. 2), denotes the procedure of Divine truth or the law, from Divine good. The *mountains* filled with horses and chariots of fire round about Elisha (2 Kings vi. 17), denotes doctrinals good, and true from the Lord. The *mountains* shall bring peace and the little hills by righteousness (Is. lxxii. 3), denotes love to the Lord and the neighbour, such as it was in the most ancient church. Upon every lofty *mountain*, and upon every high hill, rivers and streams of water, (Isa. xxx. 25), denotes the goods of love and charity, and the truths of faith from them, for, rivers and streams of water signify truths; like one going to the *mountain* of the Lord, to the Mighty One of Israel (Isa. xxx. 29), denotes the Lord as to the good of love and the good of charity. Get thee up into the high *mountain*, lift up thy voice with strength (Isa. xl. 9; xlii. 11), denotes the worship of the Lord from love. He that putteth his trust in me shall possess the land, and shall inherit my holy *mountain*, (Isa. lvii. 13), denotes the Lord's Kingdom where all is love and charity. The glory of the Lord upon the *mountain* east of the city (Ezek. xl. 23), denotes the sphere of celestial love from the Lord. The house and the top of the *mountain* made holy (Ezek. xlii. 12), denotes the Lord's celestial kingdom from the good of love. Judah called a *mountain* in a field, (Jer. xvii. 2), denotes the principle of celestial love in the Lord's Kingdom represented by them. The *mountain* of the congregation in the sides of the north (Isa. xiv. 13), denotes the obscure state where the influx of good, which flows in with light from the Lord, is terminated. Four chariots going out from between two *mountains* of brass (Zec. vi. 1-8), denotes the procedure of doctrinals from the good of love to the Lord and love to the neighbor in the natural degree. The *mountains* shall distil sweet wine and the hills shall melt, when captive Israel is restored (Amos ix. 13), denotes the good of love and charity when the spiritual church is delivered from falses. The Lord of hosts came down to fight for *mount* Zion and for the hill thereof (Isa. xxxi. 4) denotes the omnipotence of divine good and divine truth. Contend with the *mountains* and let the hills hear thy voice (Mic. vi. 1), denotes truths speaking with those who are chafe of heart in self-love, and with those who are in charity. And it shall come to pass in the last days that the *mountain* of the Lord's house shall be established in the top of the *mountains* and shall be exalted above the hills and all the nations shall flow unto it, and many people shall go and say, Come ye, and let us go up to the *mountains* of the Lord and to the house of the God of Jacob, and He will teach us His ways, and we will walk in His paths, (Isa. ii. 2-3) These words are spoken of the New Church to be established by the Lord; by the *mountain* of the Lord, which shall then be established in the top of the *mountains*, is understood Zion; and by Zion, is signified the celestial church, and love to the Lord which is communicated to those who belong to that church, that this is the primary principle of the church, and that it shall increase and gain strength, is signified by its being in the top of the *mountains*, and exalted above the hills; that they who are principled in the good of love shall acknowledge the Lord, and accede to the church, is signified by all nations flowing to that *mountain*, nations signifying those who are in celestial good, which is the good of love to the Lord, and people, those who are in spiritual good, which is the good of charity towards the neighbor. They of the south shall possess the *mount* of Esau, (Obad. 19), denotes the good of love with those who are in the light of truth. His feet shall stand in that day upon the *mount* of Olives, and the *mountain* shall divide, etc. (Zec. xiv. 4), denotes the advent of the Lord in the good of love and charity, and the church formed by such goods receding from the Jews to the nations. The Lord set upon a high *mountain* and upon a pinnacle of

the temple, by the devil, denotes the extreme temptation combats that he sustained against the loves of self and the world, thus against hell. Let them which be in Judea flee into the *mountains* Matt. xxiv. 16), denotes salvation in love to the Lord and charity to the neighbor. They shall say to the *mountains*, Fall on us, and to the hills, cover us (Rev. vi. 16), denotes the state of the evil unable to bear the Lord's presence. A great *mountain* burning with fire cast into the midst of the sea (Rev. viii. 8), denotes the love of self in the scientifics of the natural man. From the examples it may be seen that there is an opposite side from love and goodness, when evil is treated of, for who does not know that there are mountains of pride and self-love of a very different kind from the love of the Lord and the neighbor? Other instances could be noted, but enough has been brought forward satisfy the present purpose.

Mention has been made of those ancestors of the human race who existed in the times of primitive integrity, happiness, purity and goodness. Not without the best of reasons did the ancients speak of that period as the *GOLDEN AGE*. In modern times, for a similar reason, we speak of the *golden rule*, a heart of *gold*, *golden fruit*, *golden opinions*, *golden opportunity*, etc., and no one is ever at a loss to perceive the correspondence existing between the symbol and the preciousness of the thing or quality represented by it. The nature and qualities of gold are well known. Its red, bright color, corresponding to that of burning fire, is symbolic of love or goodness, as is also the inherent warmth of the metal. No uncombined acid can corrode or dissolve it, acids corresponds to truth falsified, which in other words is evil or wickedness, so "charity suffers long and is kind." The most intense heat has no further effect on gold than to still further purify it, while its intrinsic value renders it a most proper emblem of that desirable quality which it is used to represent or symbolize in the Word of God, viz., that of the good of love from the Lord. Silver in the internal sense of the word signifies truth, and in an opposite sense, the false. From this correspondence we can understand how the solution of silver used in photography is so sensitive to the rays of light, for natural light corresponds to spiritual light, which is the veriest divine truth, or that True Light which lighteth every man that cometh into the world. The color of silver is also in correspondence with the resplendent ray of light. Regarding gold and silver it may be well to state that in the Word they stand in a sort of mutual relation to each other, representing respectively love and wisdom, charity and faith, goodness and truth, will and understanding: the affections, or the feminine principle, and the intellectual, or the masculine principle. From this correspondence arises the mutual affinity these metals have for each other in the numerous intermixtures and appliances in the various arts and manufactures of the world. Inferior metals, such as brass, iron, etc., are used in the Word to denote a lower degree of goodness and truth. We will now approach the sacred writings to see to what extent these remarks will be confirmed. The river of Eden encompassing the whole land of Havilah, where there is *gold* and precious stones (Gen. ii. 11, 12) denotes the state of the celestial man as to love and faith. Abram's being very rich in *silver* and *gold* (Gen. xiii. 2) denotes the state of the Lord in youth as to celestial good and truth. The Israelites borrowing jewels of *silver* and jewels of *gold* and raiment of the Egyptians (Exodus xii. 35) denotes scientific truths and goods taken away from the evil, and acquired by those who are of the spiritual church. The people offering *gold* and *silver*, and brass, and blue and purple, etc., for the works of the tabernacle, denotes interior things collated and disposed in externals, where they are represented. The *gold* of the ark, and the border of *gold* round about it, denotes good in the inmost, and the common sphere of good which proceeds from the Lord, and contains all. The mercy seat and the cherubim of *gold* denotes the hearing and reception of worship, and approach to the Lord from the good of love. The table of shew bread covered with *gold*, and the border of gold round about it, denotes the reception of all that conduces to the spiritual life in good, and the sphere of good affording protection from evil. The candlestick, its branches, etc., all of *gold* denotes all mental illumination, and intelligence, or the truth of faith proceeding from good. The couplings for the curtains of *gold*, denotes the whole connection and conjunction of truths, thus the whole order and

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harmony of heaven, preserved by the good of love. The boards of cedar covered with *gold* denotes the whole merit and good of works, thus all the good that sustains heaven, from the good of love, thus from the LORD. The blue, the purple, and scarlet and fine linen of the ephod, embroidered all over with *golden* thread, denotes the universal prevalence of love, and every manifestation of charity and faith imbued therewith. The sockets of the onyx stones made of *gold*, and the chains of *gold*, denotes the subsistence and coherence of all things in the memory grounded in good. All the stones of the breastplate set in *gold*, its rings and chains of *gold*, denote all the goods and truths of the internal man proceeding from the divine good, surrounded by the sphere of good, and their indissoluble conjunction thereby. The bells of *gold* upon the border of the robe of Aaron denote all that is heard and perceived of the church, thus all doctrine and worship to be from good. The plate of *gold* engraved with "Holiness to the LORD" upon Aaron's forehead, denotes illustration and wisdom proceeding from the divine good of the LORD. The altar of incense covered with *gold* denotes the elevation or hearing and reception, of all worship rising from love and charity. Bezaleel, of the tribe of Judah, called and inspired to do these works for the tabernacle, to work in *gold* etc., denotes those who are in the good of love receiving the divine influx, and their exceeding wisdom. In the opposite sense, the ear-rings of *gold* given to Aaron to make the *golden* calf, denote the delight of external loves, which are the loves of self and the world, rendering worship idolatrous, thus the good of the external man instead of the good of love, or divine good, is represented. *Gold* signifies spiritual good, much like *gold* celestial good. (Psa. xix. 10.) I counsel thee to buy of me *gold* tried in the fire, that thou mayest be rich, (Rev. iii. 18), denotes the good of celestial love derived from the LORD. *Gold* and precious stones (Rev. xvii. 4), denotes divine spiritual good, and divine spiritual truth, both derived from the Word. How is the *gold* become dim, how is the most fine *gold* changed. (Lam. iv. 1), denotes the spiritual and celestial goods of the church lightly esteemed through declension into evil. The precious Sons of Zion comparable to fine *gold*, (Lam. iv. 2), denotes those who are in wisdom from divine truths. *Gold*, *brass*, and *wood*, (Isa. lx. 17.), represent the three celestial principles, the inmost principle is represented by gold, the inferior by brass, and the lower by wood. The use of the *gold* and *silver* vessels belonging to the temple of Jerusalem at Beshazzar's feast, while they praised the gods of gold, and of silver, of brass, of iron, of wood, and of stone, (Dan. v. 2,3,4), denotes the profanation of the knowledges of good and truth by those who are in falses, his kingdom being divided, signifies the dissipation of goods and truths, and he himself being slain that night, signify the privation of the life of good and truth, consequently, damnation. And the street of the city was pure *gold*, as it were transparent glass. (Rev. xxi. 21.) By the city, or New Jerusalem, is meant the LORD's New Church as to every thing pertaining to it interiorly considered, or within the wall; by gold is signified the good of love from the LORD, and like unto pure glass, signifies pellucid or transparent from divine wisdom, and since the latter appears in heaven as light, and flows from the LORD as a sun, just as natural light flows from the natural sun; by like unto pure glass is signified flowing in together with light from heaven from the LORD. Regarding the LORD's coming it is written, But who may abide the day of His coming? and who shall stand when he appeareth? for He is like a refiner's fire; and he shall sit as a refiner and purifier of silver, and he shall purify the sons of Levi, and purge them as *gold* and *silver*, that they may offer unto the LORD an offering in righteousness. Then shall the offering of Judah and Jerusalem be pleasant unto the LORD, as in the days of old, and as in former years (Mal. iii. 3, 4). By Levi in a supreme sense is signified love and mercy, in a spiritual sense, charity in act; consequently the sons of Levi signify those who are in the affection of truth and live in the good of life. The name denotes to *adhere*, by which in the Word, is signified conjunction through love, by the refiner's fire is denoted temptation, whereby is effected purification, which is here meant by purifying and purging them as gold and silver. By Judah is signified the LORD's celestial church, or those who love the LORD above all things, and by Jerusalem those who are in neigh-

hourly love, the offering they will bring unto the LORD is faith and charity, by the days of old and former years are meant the ancient churches, and the states of the worship of the LORD at that time. It is obvious that the sons of Levi mentioned in this passage cannot mean those who were officiating as priests during the time of our REDEEMER'S incarnation, for they were of that outrageously wicked crew who wilfully crucified the LORD of Glory. In the internal sense of the Word the twelve tribes of the children of Israel signify the church as to all its goods and truths; the same is signified by the twelve disciples of the LORD, and by the twelve gates and twelve foundations of the New Jerusalem, as it is stated regarding these last, that names were written thereon, which were respectively, the names of the twelve tribes of Israel and those of the twelve apostles of the Lamb. Jerusalem adorned with *gold* and *silver*, (Ezek. xvi. 13), the temple with its *gold* and *silver* claimed as the LORD'S, (Hag. ii. 8) denotes the church gifted with wisdom and intelligence, or celestial and spiritual knowledge. *Gold* and *silver* made into images of men and whoredom committed with them, (Ezek. xvi. 17), denotes profanation predicated of celestial and spiritual knowledges. The ships of Tarshish to bring *silver* and *gold*, (Isa. lx. 9), denotes knowledges when the LORD'S kingdom is established, by which truths and goods are acquired. He who is without *silver* invited to buy and eat, denotes such as are in ignorance of truth, but in the good of charity. *Silver* and *gold* gotten by Tyre (Ezek. xxviii. 4, Joel iii. 5) denote intelligence, or what is the same, truths and wisdom. *Silver* purified seven times (Ps. xli. 6), denotes divine truth. It is hoped that these examples will suffice to elucidate the statements made regarding the symbolic or representative sense of gold, silver, etc., in the Word.

As regards the correspondence of the sun, moon, and stars, it will be seen from what follows that these natural luminaries are also used by the Divine AUTHOR of the Word to represent spiritual and heavenly things, and in an opposite sense, things that are evil. The SUN, in the Word when the LORD is spoken of, signifies his divine love, and at the same time His divine wisdom. Forasmuch as the LORD with respect to His divine wisdom, is meant by the sun, therefore the ancients in their holy worship turned their faces to the rising sun, and also their temples, which practice is still continued. The MOON, in the Word signifies the LORD in reference to faith, and thence faith in the LORD. Stars, in a supreme sense, signifies knowledge concerning the LORD, hence stars signify intelligence of a spiritual kind, or the knowledge of good and truth, which is true wisdom. These statements will now be confirmed from the Word. "And He shall be as the light of the morning when the sun riseth, even a morning without clouds, as the tender grass springing out of the earth by clear shining after rain" (11. Sam. xxxiii. 4.). The light of the morning when the sun riseth, signifies the divine truth proceeding from the LORD as a SUN, a morning without clouds denotes the purity of that truth, rain signifies its influx, and the tender grass springing out of the earth signifies intelligence, and reformation thence originating, for these are signified by grass, because grass springs out of the earth by virtue of the sun of the world after rain, and intelligence is from the LORD as a SUN by the influx of divine truth. MORNING is used in the Word to denote every particular coming of the LORD, or when there is faith and love in the church, the evening or night denotes a time or state in which these are wanting. "Blessed of the LORD for his land, for the precious things of heaven, for the dew, and for the deep that coucheth beneath, and for the precious fruits brought forth by the sun, and for the precious things put forth by the moon" (Deut. xxxiii. 13, 14.). This particular blessing was pronounced on Joseph, for the reason that by Joseph are understood the spiritual celestial, who are the highest or supreme in the spiritual kingdom. By his land is signified that Kingdom, likewise the church thence derived. By the precious things of heaven, the dew, and the deep that coucheth beneath, are signified things that are spiritual celestial in the internal and external man. By the precious things brought forth by the sun and the precious things put forth by the moon, are signified all things which proceed from the LORD'S celestial kingdom, and all which proceed from His spiritual kingdom, consequently all the goods and truths which are thence derived. "Praise ye the LORD, praise ye Him all His hosts. Praise ye him sun and

and charity, churches, and obvious that the who were officiation, for they lifted the Lord's of the child- the same is ve gates and egarding these vely, the names es of the Lamb, he temple with tes the church ual knowledge, committed with of celestial and *silver* and *gold*, n is established, it *silver* invited but in the good 11. 4, Joel III. 5) m. *Silver* purloped that these arding the sym- ord. stars, it will be also used by the heavenly things, n, in the Word and at the same poet to His divine elr holy worship s, which practice ord in reference ne sense, signifies intelligence of a h is true wisdom. And He shall be morning without ear shining after en the sun riseth, a SUN, a morning gnifies its influx, intelligence, and y grass, because world after rain, x of divine truth. ar coming of the evening or night essed of the Lord dew, and for the brought forth by on" (Deut. xxxiii. n Joseph, for the stial, who are the and is signified that precious things of re signified things n. By the precious s put forth by the Lord's celestial kingdom, conse- derived. "Praise ye him sun and

moon, praise Him, all ye stars of light" [Psa. cxlviii. 2, 3]. Here by praising the LORD is signified to worship Him. By the angels are signified those who are in divine truths from the good of love, for all such are angels. By all His hosts are signified goods and truths in their whole compass. By the sun and moon are signified the good of love, and the truth from that good. By the stars of light are signified the knowledge of truth from good. Inasmuch as man worships the LORD from those things which he receives from the LORD, thus from the goods and truths that are in him, and as it is also by virtue of such things that man is man, it is therefore said to such things namely, to the sun, moon, and stars, by which are signified goods, truths, and knowledges of truths, that they should worship the LORD. It is clear that the command is not addressed to those luminaries which enlighten the natural world, for how can such things offer praise and worship? And God made two great lights, the greater light to rule the day, and the lesser light to rule the night, He made the stars also [Gen. 1. 16]. The subject treated of in this chapter is the new creation or regeneration of man, that is of those who constituted the Most Ancient church which is here described in the literal sense of the Word by the creation of the heavens and the earth, those who imagine that this description applies to the creation of the natural universe are much deceived, for how could day and night, or light have an existence previous to the creation of the sun, which according to this account did not come into being until the fourth day? Or how could the earth bring forth grass or the herb yield seed, or the fruit tree yield fruit after his kind, before the sun of nature came into being? These and many other objections have been brought forward by infidels and scoffers, against the authenticity of the Word, and by many others who would consider themselves sorely aggrieved by having these terms applied to them, many who are indeed earnest seekers after truth. Let all such know that the Word of God as revealed to us, and the works of God as made known to us through those faculties with which He has endowed us, are never in conflict and never contradict each other, but are always in heavenly correspondence and celestial harmony one with the other. God's love in the will, and His truth in the understanding, are here called two great lights, and afterwards love is called a greater light, and faith a less, and it is said of love that it shall rule by day, and of faith that it shall rule by night. The Most Ancient church acknowledged no faith but love itself; and the universal heaven is of love, no other life being existent in heaven but the life of love. From love is derived all heavenly happiness, which is so great that no degree of it admits of description, or can ever be conceived by any human idea. Those who are under the influence of love, love the LORD from the heart, but yet know, declare, and perceive, that all love, and consequently all life which is of love alone, and thereby all happiness, come only from the LORD and that they have not the least of love, of life, or of happiness, from themselves. The profundity of the Word is such that as to its inmost sense it does not treat in the least of natural things, but only makes use of them to represent and symbolize things that are spiritual, as may be seen from the following in reference to a consummated church, as the end of the age, or "the end of the world" as it is erroneously translated in the authorized version. It is written, "Immediately after the tribulation of those days shall the sun be darkened, and the moon shall not give her light, and the stars shall fall from heaven, and the powers of the heavens shall be shaken; and there shall appear the sign of the Son of Man in heaven; and then shall all the tribes of the earth mourn, and they shall see the Son of Man coming in the clouds of heaven with power and great glory. And he shall send his angels with a great sound of a trumpet, and they shall gather together his elect from the four winds, from one end of heaven to the other". (Matt. xxiv. 29-31). By all these expressions are meant spiritual things relating to the Church, of whose final state or period they are spoken, for in the spiritual sense, by the sun which shall be darkened, is meant love to the LORD; by the moon which shall not give her light, is meant faith towards Him, by the stars which shall fall from the heavens is meant the knowledge of goodness and truth. Every intelligent person will know that it is no more possible for the stars in the firmament to fall to the earth, than it would be for a million of worlds to fall on a pebble by the sea shore. By

the sign of the Son of Man in heaven, is meant the appearance of Divine truth in the Word from Him; by the tribes of the earth which shall mourn, is meant the failure of all truth which is of faith, and of all good which is of love; by the coming of the Son of Man in the clouds of heaven with power and great glory, is meant the presence of the Lord in the Word, and revelation; by the clouds of heaven is signified the literal sense of the Word, by power and great glory is meant its internal sense, which has reference solely to the Lord and His kingdom, in each and every passage, and from this, that sense derives its power and glory; by the angels with a great sound of a trumpet is meant heaven, whence divine truth comes, by gathering together the elect from the four winds, from one end of heaven to the other, is meant a new heaven and a new Church, to be formed of those who have faith in the Lord and live according to His precepts. "Behold the day of the Lord cometh, for the stars of heaven and the constellations thereof shall not give their light, the sun shall be darkened in his going forth, and the moon shall not cause her light to shine, (Isa. xlii., 9-10). I will cover the heaven and make the stars thereof dark, I will cover the sun with a cloud, and the moon shall not give her light, (Ezek. xxxii. 7-8.) The day of the Lord is near, the sun and moon shall be darkened, and the stars shall withdraw their shining, (Joel, iii, 14-15.) The same idea is visible in all these passages. By the day of the Lord, is meant His advent, which was at a time when there was no longer any good of love or truth of faith remaining in the Church, or any knowledge of the Lord, therefore it is called a day of darkness and thick darkness. From want of knowledge respecting the spiritual sense of the Word, as unfolded by the science of correspondences, many Christians at the present day suppose that the Lord will appear in the clouds of the atmosphere, and, accompanied by the whole of the heavenly host, will be visible to the natural eye, when the dead bodies and mouldering dust of all who have ever lived on the earth will be raised (at the sound of the archangel's trumpet), out of their graves, and wherever else their dust may be scattered, no matter what form they may have assumed. It is thought this inconceivable mass of corruption will be raised up, and the soul of each be re-implanted, the judgment set, and the books opened, each one being judged out of what is written in these books, just as if the Omniscient One could possibly require a set of books; that then the earth and all that is therein will be burnt up, the stars fall from heaven and the sun and moon be blotted out from the creation. Many good people entertain these thoughts because things are thus described in the letter of the Word, but the case is far otherwise, for it is most true that by *clouds* in the Scripture is meant the Word in the letter, for it is written that "His strength is in the clouds," that "His truth reacheth unto the clouds," that "He maketh the clouds His chariot," that "His faithfulness reacheth unto the clouds," that the "clouds are the dust of His feet; that thick clouds are a covering to Him. In his unclouded purity, He is described as a "morning without clouds." These and many other similar expressions can never be predicated of the clouds of nature, but that they are true of the Word is most clearly manifest; hence, when the Lord is spoken of as coming in the clouds of heaven, a literal or personal coming is not to be understood or expected, but instead thereof, an unfolding or opening of that spiritual or internal sense of the Word which has hitherto lain so deeply concealed within the clouds of the letter, and which as to its inmost is the Lord Himself, and though the announcement may seem premature, this coming has actually taken place during these latter days by and through the disclosure of that sense to mankind. But more regarding this in what follows. When rightly understood, the Word teaches that the only resurrection that will ever be accorded to man's body consists in the raising up of the soul or spiritual body, which takes place immediately after natural death, and after death, the judgment. This does not take place in this world, but in the spiritual world into which every one enters after the death of the body, the books which will then be opened, and from which he will be judged, signify the interiors of the mind of man, because in them are written all things appertaining to his life.

Another resurrection is indeed spoken of in John v. 25., as follows:—
 "The hour is coming, and now is, when the dead shall hear the voice of

the Son of God, and they that hear shall live : plainly indicating a resurrection from the graves of carnality and the love of self and the world, which is spiritual death, to the life of spiritual mindedness, and the love of the Lord and the neighbor, which alone is true life. This resurrection must take place during man's life in the body, it cannot take place after death, for such as the ruling love is in this life it will irrevocably remain to all eternity. It is also a great fallacy to infer from any description in the Word, that this earth will ever be destroyed, no such doctrine being ever taught or inculcated therein. In the modern discoveries of geology, the testimony of God through His works, points unerringly to the sublime truth that Infinite power has been constantly engaged during countless millions of ages in preparing the earth for the abode of man. It has been created that the human race might exist, and thence heaven, for the human race is the seminary of heaven, and when infinite Love is satisfied to its fullest capacity with intelligent and rational beings on whom it may shower its blessings and celestial beatitudes, for it creates them for no other end, then, just so soon but no sooner, will the procreations of the human race cease, and the world become a blank in the creation. The most ample testimony is not wanting to prove that it was He who laid the foundations of the EARTH, that it should not be removed for EVER," Ps. CIV., 5 "He built his sanctuary like high palaces, like the EARTH which he hath established FOR EVER," Ps. LXXVIII 69. "The world also is established that it CANNOT BE MOVED," Ps. XCIII. 1. "Say among the heathen that the Lord reigneth : the world also shall be established that it SHALL NOT BE MOVED, Ps. XCVI. 10. "One generation passeth away, and another generation cometh, but the earth ABIDETH FOR EVER. Eccles. I, 4. Of the sun, moon, and stars, we read :—"They shall fear thee as long as the SUN AND MOON ENDURE, throughout ALL GENERATIONS," Ps. LXXII., 5. "His name shall endure FOR EVER ; his name shall be continued as long as the sun,"—ver. 17. "Praise ye him, sun and moon : praise ye him all ye stars of light. Let them praise the name of the LORD ; for he commanded, and they were created. He hath established them FOR EVER AND EVER : he hath made a decree which SHALL NOT PASS," Ps. CXLVIII., 3, 5, 6. These enunciations are certainly all that will be required to manifest the divine intention that the universe shall not cease to exist. A perishing earth is used in the language of correspondences to describe a perishing church in the following and many other passages "The earth is utterly broken down, the earth is *clean dissolved*, the earth is *moved exceedingly*," Isa. XXIV, 19. "The curse devoured the earth and they that dwell therein are desolate ; therefore the *inhabitants of the earth are burned*, and few men left," Isa. XXIV 6, "For my people is foolish and they have not known me ; they are sottish children, and they have no understanding ; they are wise to do evil, but to do good they have no knowledge, I beheld the earth, and, lo, it was *without form and void*, and the heavens, and they had no light," Jer. iv. 22, 23. Here we have the picture of an apostate church in a state of declension from goodness, described by the earth being *clean dissolved*, as *moved exceedingly*, as being *without form and void*, and the inhabitants thereof as being *burnt up*. It is most evident that neither of these statements can be literally true of the natural earth. It is written in Joel "In those days will I pour out my spirit and I will show wonders in the heavens and in the earth, blood, and fire, and pillars of smoke. The sun shall be turned into darkness, and the moon into blood, before the great and terrible day of the LORD come," II. 30., 31. The apostle Peter on the day of Pentecost, Acts XI, 16, 21, cites the entire passage from Joel, and refers to it as being fulfilled on that day, but we know as well as we can know any thing, that these great commotions did not actually take place in the kingdom of nature, at that time. Our ever blessed LORD and glorified REDEEMER was seen by the beloved disciple in Apocalyptic vision, as "One like unto the Son of Man, clothed with a garment down to the foot and girt about the paps with a golden girdle. His head and his hairs were white like wool, as white as snow, and his eyes were as a flame of fire, and his feet were like unto fine brass as if they burned in a furnace, and his voice as the sound of many waters. And he had in his right hand seven stars, and out of his mouth went a sharp two-edged sword, and his countenance was



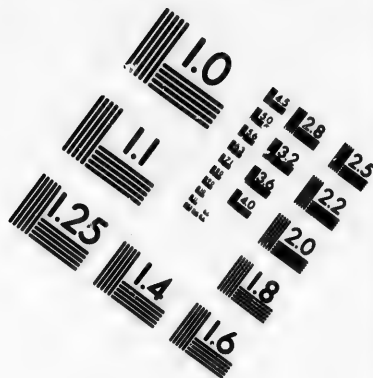
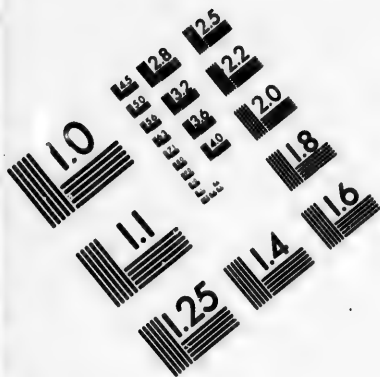
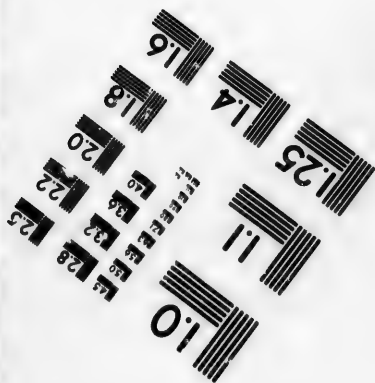
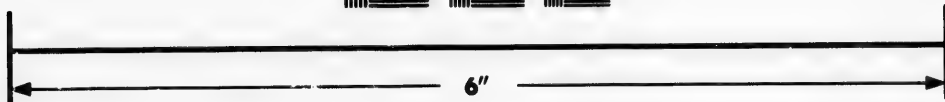
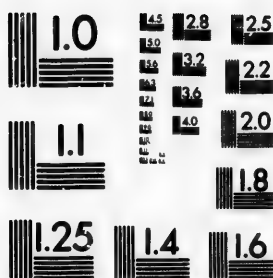


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as the *sun* shining in his strength." Rev. i, 13, 16. One like unto the Son of Man, signifies the LORD as to the Word, clothed with a garment down to the foot signifies the proceeding divine, which is divine truth, for garments in the Word denote truths, and girt about the paps with a golden girdle signifies the proceeding and at the same time the conjoining divine which is divine good; by the paps or breast, divine love is signified, as is evident from those passages in the Word where they are mentioned, as also from their correspondence with love; and his eyes were as a flame of fire, signifies the divine wisdom of the divine love, and his feet like unto fine brass as if they burned in a furnace, signifies divine good natural; fire, or what burns, signifies good; and fine brass signifies the good of truth natural, therefore by the feet of the Son of the Man like unto fine brass, as if they burned in a furnace, is signified divine good natural, and His voice as the sound of many waters, signify divine truth natural; for waters in the Word denote truth; and in his right hand seven stars, signifies all knowledges of good and truth in the church from Him, which are thence with the angels of heaven and men of the church; and out of his mouth went a sharp two-edged sword, signifies the dispersion of falses by the Word and by doctrine thence from the LORD; and his countenance was as the sun shining in his strength, signifies His divine love from which are all things of heaven, for this is the signification of faces when predicated of the LORD as denoting His divine love, from which is all good, thus also all things of heaven. Regarding the blessings promised to him that overcometh, it is written, "And I will give him the morning star." Rev. 22, 17, signifying that intelligence and wisdom from the divine human principle of the LORD will be imparted to all those who love and obey Him. Literally understood such a gift would be incomprehensible, for how could the morning star of nature be given to any one? "And there appeared a great wonder in heaven; a woman clothed with the sun, and the moon under her feet, and upon her head a crown of twelve stars; and she, being with child, cried, travailing in birth, and pained to be delivered. And there appeared another wonder in heaven; and behold a great red dragon, having seven heads and ten horns, and seven crowns upon his heads, and his tail drew the third part of the stars of heaven and did cast them to the earth; and the dragon stood before the woman which was ready to be delivered, for to devour her child as soon as it was born." Rev. 12, 1-4. And there appeared a great wonder in heaven, signifies revelation from the LORD concerning the New Church in the heavens and on earth, and concerning the difficult reception and resistance which its doctrines will meet with. A woman clothed with the sun, and the moon under her feet, signifies the LORD's New Church in the heavens, which is the new heaven, and the LORD's New Church about to be upon earth, which is the New Jerusalem, for it has pleased the LORD in His Word to cause His Church to be represented under the similitude of a woman, as well as by the symbol of a city, as witness "Come hither, and I will shew thee the bride, the Lamb's wife." Rev. 21, 9. Where by the LAMB is signified the LORD as to the essential innocence of His Divine Human nature, and by the bride is signified His church, represented by the New Jerusalem about to be conjoined to Him. The reason why she appeared clothed with the sun is, because this church is principled in love to the LORD, for it acknowledges Him, and does His commandments, and this is to love Him. By the moon is signified intelligence in the natural man, and faith, and the reason why the moon was seen under her feet is, because the church on earth is understood, which is not yet conjoined with the church in heaven; by appearing under her feet is further signified that it is about to be upon earth, and will as to doctrine be grounded on the divine truths of the Word; and upon her head a crown of twelve stars, signifies the wisdom and intelligence of this church from knowledges of divine good and divine truth derived from the Word; by the crown on her head is signified wisdom and intelligence, and by stars are signified the knowledges of divine good and truth. And she being with child, cried, travailing in birth, and pained to be delivered, signifies the doctrine of the New Church about to come forth, and its difficult reception in consequence of the resistance it meets with from those who are understood by the dragon. To be with child signifies the birth of doctrine, because by the child which was in the

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womb, whose birth is treated of in ver. 5. is signified the doctrine of the New Church, for nothing else is signified by being with child or in travail and bringing forth, in the spiritual sense of the Word, but to conceive and bring forth those things which relate to spiritual life.

And there appeared another wonder in heaven; signifies revelation from the LORD concerning those who are against the New Church and its doctrine. And behold a great red dragon, signifies those in the Reformed Church who make GOD three, and the LORD two, and separate Charity from Faith, and insist on the latter being competent to salvation without the former. Such are here meant and in what follows, by the dragon: for they are against the two essentials of the New Church, which are, that GOD is one in essence and in person, in whom there is a Trinity, and that the LORD is that GOD; also that charity and faith are a one as an essence and its form; and that none have charity and faith but those who live according to the commandments, which say that evils are not to be done, and in proportion as any one does not commit evils, by shunning them as sins against GOD, in the same proportion he does the goods which relate to charity, and believes the truths which relate to faith; having seven heads, denotes insanity from the profanation and falsification of the truths of the Word; and ten horns, which denotes much power, and seven crowns upon his heads, signifies all the truths of the Word falsified and profaned; and his tail drew the third part of the stars of heaven, and did cast them to the earth, signifies that, by falsifications of the truths of the Word they have alienated all spiritual knowledges of good and truth from the church, and by application to false doctrines have entirely destroyed them: and the dragon stood before the woman who was ready to be delivered, to devour her child as soon as it was born, signifies that they who are meant by the dragon will endeavour to extinguish the doctrine of the New Church at its birth. In the narrative continued in verse 5, by "she brought forth a male child," is denoted the doctrine of the New Church; "who was to rule all nations with a rod of iron, signifies which, by truths from the literal sense of the Word, and at the same time, by rational arguments drawn from the light of nature, will convince all who are in dead worship through being principled in faith separated from charity that are willing to be convinced. "And her child was caught up to God and to his throne," signifies the protection of the doctrine by the LORD because it is for the use of the new church, and its being guarded by the angels of heaven. "And the woman fled into the wilderness," signifies the new church which is the new Jerusalem, at first confined to a few, where there are no longer any truths, for by a wilderness in the Word, is signified, I. The church devastated, or in which all the truths of the Word are falsified, such as it was among the Jews at the time of the LORD's advent. II. The church in which there were no truths, from not possessing the Word, such as it was among the well-disposed Gentiles in the LORD's time. III. A state of temptation, in which man is, as it were, without truths, because surrounded by evil spirits who induce temptations, and then, as it were, deprive him of truths. It will be seen from this that a spiritual wilderness is in exact correspondence with a natural wilderness, which signifies a place where there is little or no water, for water denotes truth. Passages from the Word in corroboration of these statements are too numerous to be cited here, but will occur to every attentive reader of its contents. And the city had no need of the SUN, neither of the MOON, to shine in it, for the glory of GOD did lighten it, and the LAMB is the light thereof, Rev. xxi., 23. By the sun is here signified natural love separate from spiritual love, which is self love; and by the moon is signified intelligence and also faith natural, separated from intelligence and faith spiritual, which is self-derived intelligence and faith from self; this love, and this intelligence and faith, are here signified by the sun and moon, which will not be required to shine upon those who will be in the LORD's New Church; by the glory of GOD which lightens it, is signified the divine truth of the Word, and because that light is from the LORD, it is said that the light thereof is the Lamb. "That ye may be the children of your Father who is in heaven; for he maketh his SUN to rise on the evil and the good, and sendeth rain on the just and on the unjust," Matt. v., 45, signifies in the spiritual sense that from the LORD, as a sun,

proceeds light and heat; the light which proceeds, inasmuch as it is spiritual light, is the divine truth, and the heat inasmuch as it is spiritual heat, is the divine love; these flow from the LORD continually into every man, but are variously received according to the state of the recipient; by the evil they are turned into evil and what is false, by the good they are received as good and truth, and are thus comforted and built up by them. The correspondence is closely seen in the case of the sun of nature, which although it emits nothing but light and heat into external objects, still the effects are very different on a putrid carcass, and the growing fruits of the earth, or a beautiful flower garden. Again, in David, "His seed shall endure for ever, and his throne as the SUN before me. It shall be established for ever as the MOON," Ps. LXXXIX., 36, 37. By David, who is here treated of in the literal sense, is understood the LORD. By his seed which shall endure for ever, is signified the divine truth, and all those who shall receive it. By His throne which shall endure as the sun, is signified heaven and His church, which are principled in celestial good, which is the good of love. By His throne which shall be established as the moon for ever, is signified heaven and the church which are principled in spiritual good, which is the divine truth. Concerning those who love the LORD it is written, "Let them who love Him be as the SUN when he goeth forth in his might," by which is signified the operation of the Lord's divine love in them. Again, in Is. LX., 20, "Thy SUN shall no more go down; neither shall thy MOON withdraw itself; for the LORD shall be thine everlasting light." These words treat of the LORD, and of the new heaven and new earth, that is concerning the church to be established by Him. That the good of love to the Lord should not perish, nor the good of charity towards their neighbour in those who belong to that church, is understood by, "Thy sun shall no more go down, neither shall thy moon withdraw itself;" That they shall continue to eternity in truths from the good of love, is understood by, "The LORD shall be thine everlasting light, and the days of thy mourning shall be ended," everlasting light being predicated of those who are in the good of love to the LORD, and ending of the days of mourning, of those who are in the good of charity towards their neighbour. In an opposite sense, we have, "The SUN shall not smite thee by day nor the MOON by night, The LORD shall preserve thee from all evil; he shall preserve thy soul," Ps. cxxi., 6, 7. By the sun is here understood the love of self, and by the moon the false principle thence derived; inasmuch as all evil is from that love, and from evil what is false, therefore it is said, "The LORD shall preserve thee from all evil; he shall preserve thy soul," the soul here signifying the life of truth. This is the sun meant by our blessed LORD in the parable when he says, "But when the SUN was up it was scorched, and because it had no root it withered away," Mark iv., 6. This is the sun that has ripened and brought forth more direful fruits of evil than all other causes combined, having in short, populated hell with inhabitants, and filled the earth with every phase of woe and misery which it contains; it is the very opposite of that SUN of which it is written; "But unto you that fear my name shall the SUN of Righteousness arise with healing in his wings," Mal. iv., 2. The sun of righteousness here denotes the divine celestial principle, or the Lord as to the good of love; and the wings of the LORD in which there is healing signifies truth from that good, which is the divine spiritual principle; healing denotes reformation thereby. From this uncreated and infinitely glorious SUN, as from a boundless ocean, is derived all the blessings of love, wisdom, mercy and happiness enjoyed by all in heaven or on earth; through and by the reception of its influent life every thing exists, without it nothing can exist, either in the visible or the invisible creation, and just so far as our wills and understandings are expanded to receive and appropriate the ineffable delights which it communicates, just so pure, unsullied and seraphic will be our joys and beatitudes both in this world and that which is to come, for in that SACRED PRESENCE there is fullness of joy, and pleasures for evermore.

Note the correspondence of oil and wine in the parable, where our LORD said of the Samaritan, that coming to the man who was wounded by thieves, he bound up his wounds, and poured in oil and wine, Luke x. 34 where by oil and wine is not meant these things, but the good of love and

charity, by oil the good of love and by wine the good of charity, and of faith, for the subject treated of is concerning the neighbour, thus charity towards him, "Thou preparest a table before me in the presence of mine enemies: Thou anointest my head with oil, my cup runneth over," Ps. xxiii. 5. To prepare a table and anoint the head with oil denotes to be gifted with the good of charity and love; my cup runneth over, denotes that the natural principle will be thence filled with good and truth. Again, "I have found David my servant, with my holy oil have I anointed him" Ps. lxxxix. 20 where by David is meant the LORD, the oil of holiness with which he was anointed, signifies the Divine good of the Divine love. By the oil or ointment on the head and beard of Aaron, Ps. cxxxiii. is denoted celestial and spiritual good or the good of love to the LORD and the good of charity to the neighbour, for it is compared to the dew of Hermon that descended upon the mountains of Zion; for there the LORD commanded the blessing, even life for evermore. By the dew of Hermon that descended upon the mountains of Zion is signified that holy principle of divine truth proceeding from celestial good which causes unutterable felicity in the mind of the man in whom it reigns, and which is described as that "peace which passeth all understanding." From oil denoting celestial good and spiritual good we may see the reason why it was used in the anointing of the Kings of Israel, also the significance of the anointing oil for the priests, and its use on the vessels and lamps of the tabernacle, as well as in the flour and cakes for the offerings &c. From this also may be understood the meaning of oil in the parable of the ten virgins, Matt. xxv. 1. and the command not to hurt the wine and the oil, Rev. vi. 6, and a hundred other places when it is mentioned in the Word. To descend to lower things, see with what quietness and beauty a line of shafting will run at a high velocity on brass bearings when well lubricated with oil; brass corresponds to natural good and oil to celestial good; try the same experiment on iron bearings, without oil, iron corresponds to natural or sensual truth, which is hard and grating, and witness the consequences! Let us ascend a step higher and witness the delight we experience in holding intercourse with a person of a sincere, kind, considerate and obliging disposition, for in his every word and look we can behold in his countenance traces of that "oil which maketh the face to shine."

We will find the correspondence of bread and water, and flesh and blood equally instructive. Bread and water are spoken of, when all the goods of love and truths of faith are meant. Truth, in regard to good, is as water in regard to bread, or as drink in regard to meat, in nourishment. Bread signifies the primary principle which nourishes the soul, as it denotes the flesh of the LORD, by which is signified the divine good or love, hence He says "The bread of God is he that cometh down from heaven, and giveth life unto the world" John vi. 33, and again, "I am that bread of life" vers. 48, and from this it comes that the bread in the holy supper denotes the LORD, and all the celestial principles of love as proceeding from Him, which is meant when He says, "Whoso eateth my flesh, and drinketh my blood, hath eternal life; and I will raise him up at the last day," (ver. 54) and again, "He that eateth my flesh, and drinketh my blood, dwelleth in me and I in him, verse 56. To eat the LORD's flesh and drink His blood is to receive His divine love in the heart or will, and His divine truth in the understanding, and to live a life according to them, for by this, conjunction is effected, and this is the reason why bread and wine were appointed to be used in the Holy Supper, for by bread is signified the LORD's divine love, and by wine is denoted His divine truth, eating signifying appropriation and conjunction, hence the LORD's supper is in very deed the holiest act of worship. The bread of the sacrifices represented the good of love to the LORD, hence it is written "Thou desirest not sacrifice, thou delightest not in burnt offering; the sacrifices of God are a broken spirit," Ps. li. 16, 17, by which is signified an humble heart, which confesses that man's own intelligence is nothing, and that from the LORD alone proceed every thing of goodness and truth that man can receive. By bread in the LORD's prayer as well as in the holy supper, is signified in the supreme sense, the LORD and the things of celestial love. In an opposite sense, to eat bread in the sweat of the face, Gen. iii. 19, represents celestial truths

received in a state of aversion. The Children of Israel lusting for *flesh* and the *flesh pots* of Egypt represents the desire of the natural man to live in a corporeal manner, that is, in the loves of self and the world. The flesh of the foreskin to be circumcised denotes the removal of the defiled loves of the natural man. The way of all *flesh* corrupted, signifies the understanding of truth totally destroyed in the corporeal state of man.

By the call addressed to every feathered fowl, and every beast of the earth to eat of the *flesh* of the mighty and drink the *blood* of the princes of the earth, of rams, of lambs, of goats, of bullocks, etc., on the mountains of Israel, and to be filled with horses and chariots, mighty men, and all men of war, Ezek. xxxix, 16, 17, the Holy supper is signified, for in Rev. xix, 17, it is called the supper of the Great God, by every feathered fowl, and by every beast of the field, is signified man as to his thoughts and affections, or understanding and will; the mountains of Israel denotes the good of love and charity; these things which form the feast denote all spiritual and celestial things proceeding from the Lord Himself, as to the good of His divine love, and the divine truth of His wisdom. This is the spiritual sense of the passage, for it is clearly impossible that such things could be literally eaten. The feast of unleavened bread, or Paschal, was to signify the subjugation of hell, and the glorification of the Lord's humanity, for it denotes His presence with deliverance, hence it was forbidden to eat of any thing leavened, because a fermenting agent denotes truth false from evil. Spiritual good is signified by those words in Ezekiel: "A new heart also will I give you, and a new spirit will I put within you; and I will take away the stony heart out of your flesh, and I will give you a heart of *flesh*, xxxvi, 26. In the Word, *heart* signifies love; hence the love of good is signified by a heart of flesh. *Water*, in the Word denotes truth, and for this reason waters and rivers are described, where gardens and rivers are mentioned, as significatives of the man of the Church. To draw water denotes to be instructed in the truths of faith and to be illustrated. Drawers of water, such as the Gibeonites were, denote those who desire to know truths for no other end than to know them. A flood of water denotes temptation and desolation, because wicked persuasions and thoughts actually flow in from evil spirits. Wells of unclean water denote what is not true, Broken cisterns denote doctrines in which are no truths. In beautiful correspondence with this divine symbol of truth we will find that in physics, or the science of natural things, that man applies the same standard to ascertain the weight of solids and liquids, each being said to be heavy or light specifically as they relate to water; thus the exact weight of a cubic inch of gold, compared with that of a cubic inch of water, is called its *specific gravity*. Weight, spiritually considered, is nothing else than real worth, hence we have the expressions, solid men, or men of worth or truth, and weighty words, or words of wisdom. Furthermore, as Omnipotent power is continually predicated of the Lord as having relation to the principle of His divine truth, and this truth being symbolized by water, so none in civilized life can possibly be ignorant of the corresponding prodigious power derived from water in the various uses it performs in the world, and the cleansing properties of divine truth on the heart, when it is applied to the life, and water, when it is applied to the body, should be equally well known. Some may be solicitous to know the reason why so much is said regarding love and wisdom, or good and truth in the above passages, and the enquiry is reasonable and just. In answer to this I would state that all the attributes and perfections of the ever blessed God resolve themselves as in a focus into these two, viz: Love and Wisdom, or what is the same, Good and Truth, corresponding to heat and light, or what is the same, warmth and illumination, as proceeding from the sun of nature, and these in the CREATOR form a one, constituting what has been called a marriage of good and truth. Man, being created in the image of God, ought to present a finite transcript of those attributes which exist to an infinite extent in his Maker, and on examination this will be found to be the case, for there is no quality inherent in man but what belongs either to his will or understanding. What does not belong to one of these, forms no part of the man, and these together form one mind, and the mind is what constitutes the man himself, the body being merely a clothing eliminated from the ultimate

things of nature, such as carbon, phosphorus, silicon, chlorine, phosphate of lime, sulphur, iron, magnesium, water, potassium, &c. &c., of all of which man is divested by natural death, never more to resume them, but nevertheless he finds himself in the other life, possessed of the human form, and every member, faculty and sense which he enjoyed in this life, but much more keen, delicate and refined, by purification from the things of nature. Those things just mentioned are what constitute flesh and blood, of which it is written, that they shall not inherit the Kingdom of God, and one has well observed that you may as well attempt to raise a ship from the bottom of the ocean and leave down there all the wood and iron, as to raise a natural body without flesh and blood. We are much at a loss to conceive what possible improvement could be effected by the union of natural bodies to the spiritual bodies of those countless myriads which formed the mighty population beheld in heaven by the beloved disciples in the Isle of Patmos. Let us go a step further and investigate the works of God as seen in the visible creation, and here everything will be seen to reflect the attributes of the Almighty, but always in correspondence with His love and wisdom, or goodness and truth. From this correspondence every thing seems to go in pairs, for here we find male and female, body and soul, sun and moon, heat and light, land and water, flesh and blood, heart and lungs, gold and silver, brass and iron, and so on throughout all the ramifications of nature even down to the ultimates. What is true of God's works must in a still more exalted sense be true of that Word which is the transcript of His own perfections, and the embodiment of His divine love and wisdom; hence it comes that in the Word there is nothing but what has constant reference to either one or the other of these attributes, or of something in connection with them, or in opposition to them, such as evil and the false, and from this arises further, an apparent repetition of the same idea, sentiment or thought, very often in the course of a single verse, but it ought to be known that one of these expressions has relation to the divine Love, and the other to the divine Wisdom, or something in connection with them, or in opposition to them, as no vain reiteration can ever be predicated of the divine Word. In order to analyze the subject still further, take for instance that inimitable blessing wherewith Aaron and his sons were commanded to bless the children of Israel: "The Lord bless thee and keep thee, the Lord make His face to shine upon thee, and be gracious unto thee: the Lord lift up His countenance upon thee, and give thee peace." Numb. vi. 24, 26. In the internal sense these words signify that the Lord from divine love flows in with divine truth and with divine good into all those who receive Him. The divine love from which the Lord flows in is understood by the face of the Lord, and the divine truth with which He flows in, is understood by the Lord making His face to shine upon them; and the divine good with which He flows in, is understood by the Lord lifting up His countenance upon them; defence from evils and falsities, which otherwise would take away the influx is understood by "the Lord keep thee and be gracious unto thee," heaven and eternal felicity, which are the gift of the Lord by His divine goodness and divine truth, are understood by "and give thee peace," for when evils are removed from man, the interior of his mind is filled with celestial beatitudes and joy unspeakable. In their inmost sense these divine expressions contain such a deep meaning, and embrace such transcendent blessings that even a very faint idea of them is in a manner incommunicable to man in his present state of existence. Again in David, "Thy mercy, O Lord is in the heavens: and thy faithfulness reacheth unto the clouds. Thy righteousness is like the great mountains, thy judgments are a great deep," Ps. xxxvi. 6, 7. Where mercy and righteousness have relation to the love of God, and faithfulness and judgment have relation to His truth. Again in Isaiah, "And on this mountain shall the Lord of hosts make unto all people a feast of fat things, a feast of wines on the lees, of fat things full of marrow, of wines on the lees well refined," xxv. 6. The subject treated of is concerning the advent of the Lord, and by a feast of fat things is denoted the communication of goods, and by a feast of lees or of the best wine, the appropriation of truths. Again in Genesis, "Judah is a lion's whelp; from the prey, my son, thou art gone up; he stooped down, he couched as a lion and as an old lion; who shall rouse him up?"

XLIX. 9. By Judah is here signified the LORD's celestial kingdom, where all are in power from the LORD by divine truth; this power is understood by a lion's whelp, and by an old lion; by the prey from which he went up, is signified the dissipation of falsities and evils; by stooping down is signified to put himself into power; by couching is signified to be in security from every falsity and evil, wherefore, it is said, "who shall rouse him up." Again, O LORD my GOD thou art very great, thou art clothed with honour and majesty," Ps. civ. 1. There by being clothed with honour and majesty, when predicated of the LORD, is signified his girding Himself with divine truth and divine good, for they proceed from Him, and thence gird Him, and thus constitute heaven. Again in John, "In the beginning was the WORD and the WORD was with GOD, and the WORD was GOD. The same was in the beginning with GOD. All things were made by him, and without him was not any thing made that was made. In him was life: and the life was the light of men," John i. 1. 4. From these passages it is evident that the LORD is GOD from eternity, and that this GOD is Himself the LORD who was born into the world, for it is said that the WORD was with GOD and GOD was the WORD; as, also, that without Him was not anything made that was made, Why the LORD is called the WORD, is but little understood in the Church; He is however called the WORD because the WORD signifies Divine Truth, or Divine Wisdom; and the LORD is Divine Truth itself, or Divine Wisdom itself, for which reason He is likewise called the LIGHT which lighteth every man that cometh into the World. From the LIFE and LIGHT which pervades the WORD comes the vivification of the affections of that man's will who reads it devoutly; and the illumination of the thoughts of his understanding, there being something intimately affecting the heart and spirit which flows with light into the mind, and bears witness, Divine Love and Divine Wisdom constitute a one, and were from eternity a one in the LORD, wherefore it is said, "In him was life and the life was the light of men." This oneness is meant by these words, "In the beginning was the WORD and the WORD was GOD." By the Father is denoted the Divine Love, or the LORD as to Divine Good. By the WORD made flesh is signified the LORD as to the Divine Human principle which He assumed by being born into the world, from whence He is called "the Only Begotten of the Father" the "sent of GOD" the "Arm of the LORD," for the Divine Good, or the Father, filled this Human principle as the soul fills the body, not indeed, in perfect fulness at first, but beginning as it were from a germ, the Divine principle gradually expanded during His life on the earth, sustaining Him, and enabling Him to overcome, in the conflicts, combats and temptations admitted into His humanity from the powers of darkness, which were of such a direful nature that they are utterly inconceivable by the mind of man. The Divine principle within denoted by the Father, was that Omnipotent power which enabled him to work miracles, so that He could say, "The Father who dwelleth in me, he doeth the works," and from this also emanated those gracious words which proceeded out of his mouth, of which it is said, "I have given them the words which thou gavest me." Before his Incarnation the LORD existed in first principles only, by assuming the Humanity He as it were descended to the ultimate, or lowest principles, and from this He calls Himself "the First and the Last," Rev. i. 17. The merely human qualities derived from the mother were gradually eliminated from the assumed nature by temptations, sufferings, combats, conflicts and continual victories over the powers of darkness, who at this time held almost entire possession of the human race; by these victories He removed hell from man, and restored "that which He took not away," even man's liberty to choose life or death for himself, and furthermore glorified His Humanity, and made it Divine, or One with that Divine Good in which he existed from eternity, so that He could say before His ascension: "all power is given unto me in heaven and in earth," Matt. xxviii. 18, and after full and complete glorification, He could say to the beloved disciple in Patmos, "I am Alpha and Omega, the beginning and the ending, saith the LORD, which is, and which was, and which is to come, the Almighty," Rev. i. 8. The LORD in the WORD, is called LORD, (or Jehovah, in Hebrew, when the word LORD is printed in capitals), from the good of His divine Love, and

God, from the divine truth of His divine Wisdom; He is called CHRIST, the Anointed, in relation to His kingly office, and JESUS, signifying salvation, in relation to His office as Saviour. He calls Himself the Son of God, when His divinity, His unity with the Father, His divine power, and the life that is from Him, are treated of, and the Son of Man, when He as the Word, suffers, judges, comes into the world, redeems, saves, and regenerates. Jehovah, who was in Him, appeared to be absent in temptations, and this appearance was proportionable to the degree of His immersion in the humanity. Hence His prayers to the Father, in the Gospels and elsewhere; many of them can be seen in the Psalms, which as to their internal sense treat of the LORD alone, under the figure of David as a king. The LORD coming forth from the Father, and returning to the Father, means the humanity proceeding from the Divinity, and the union and glorification of the humanity. By the LORD's birth from eternity, is meant His birth foreseen from eternity, and provided for in time. By LORD GOD ALMIGHTY and the LAMB, mentioned Rev. xxi. 22, and elsewhere, is not meant two divine persons, but by LORD GOD Almighty or Lord God Omnipotent, is signified the LORD from eternity, who is JEHOVAH Himself, and the LAMB signifies the divine Humanity which JEHOVAH assumed by birth into the world, by virtue of which He became Emmanuel, or God with us. From these observations it may be seen that the LORD is the GOD of heaven and earth; that in Him is the Divine Trinity of Father, Son and Holy Spirit, or the WHOLEFULNESS of the Godhead, corresponding to the heat, light, and emanating influence of the Sun, or of the soul, body, and proceeding operation in man, consequently that He alone is the only true Object of love and worship, in whom is the Father, for "whoso seeth Him seeth the Father.

In order to still further confirm the heavenly doctrine of the Supreme Divinity of our blessed LORD, and to show the falsity of the present prevailing doctrine which divides the Godhead into three persons, "the same in substance, equal in power and glory," or, as it is expressed by the Athanasian Creed, three persons, "each of whom by himself is God and LORD" (a doctrine which, and the assertion is made with all charity and respect for the numerous class who think otherwise, has no existence whatever in the Word, and was entirely unknown in the Church until about the time of the Nicene Council), it is thought proper to adduce the following passages from the Word. First of all, to prove the UNITY of the Divine Being, see (Deut. vi. 4.) "Hear O Israel, the LORD our GOD is ONE LORD." This divine truth is repeated by the blessed JESUS in Mark xii. 29. "I am JEHOVAH and there is none else." Isa. xlv. 18, xlv. 5. "I, even I, am He, and there is No GOD with Me." Deut. xxxii. 39. There is none other GOD but ONE" 1 Cor. viii. 4. "Thou art the GOD, even thou ALONE, of all the kingdoms of the earth," 2 Kings xix. 15. "ONE is your Father which is in Heaven" Matt. xxiii. 9. Let us learn, with grateful reverence, who this our Heavenly Father, LORD, and GOD is. Every passage of the following evidence is refulgent with the light of divine truth, for they proceed from Him who is the Truth itself, "Unto us a CHILD is born, unto us a SON is given, and the government shall be upon His shoulders, and His name shall be called, Wonderful, Counsellor, the MIGHTY GOD, the EVERLASTING FATHER, the Prince of PEACE," Isa. ix. 6. "Thou O JEHOVAH art our FATHER, our REDEEMER, thy Name is from everlasting," Isa. lxiii. 16. "Surely GOD is in Thee, and there is NONE else, there is no god, verily thou art a GOD that hidest thyself, O GOD of Israel, the SAVIOUR" Isa. xlv. 14, 15. This is said in reference to His veiling over His divine glory with the Human nature. "Thou shalt know that I, JEHOVAH am thy SAVIOUR and REDEEMER, the MIGHTY ONE of Jacob" Isa. ix. 16. "There is no GOD else beside me, a just GOD and a SAVIOUR, there is none beside me, look unto me; and be ye saved, all the ends of the earth, for I am GOD and there is NONE ELSE" Isa. xlv. 21, 22. "Thy MAKER is thy Husband; JEHOVAH OF HOSTS, is His name, and thy REDEEMER the Holy One of Israel; the GOD of THE WHOLE EARTH shall He be called," Isa. liv. 5. There can be no uncertainty as to who is meant by these announcements. "Thus saith JEHOVAH the King of Israel and His REDEEMER, JEHOVAH of Hosts; I am the FIRST, and I am the LAST, and beside me there is no GOD," Isa. xlv. 6, "I am JEHOVAH thy GOD, the Holy One of Israel &c.

SAVIOUR" Isa. xliii. 3, "Thou hast redeemed me, O JEHOVAH GOD of truth," Ps. xxxi. 5, "I will help thee, saith JEHOVAH and thy REDEEMER, the Holy One of Israel," Isa. xli. 14, "As for our REDEEMER, JEHOVAH OF HOSTS is His NAME, the Holy One of Israel," Isa. xlvii. 4, "Thus saith JEHOVAH thy REDEEMER, and He that formed thee from the womb; I am JEHOVAH that maketh *all things*, that stretcheth forth the heavens *alone*, that spreadeth abroad the earth *by myself*," Isa. xlv. 24, "I, even I, am JEHOVAH and besides Me THERE IS NO SAVIOUR," Isa. xliii. 11, "Thus saith JEHOVAH, your REDEEMER, the Holy One of Israel," ver. 14, "With everlasting kindness will I have mercy on thee, saith JEHOVAH thy REDEEMER," Isa. liv. 8, "Thus saith JEHOVAH thy REDEEMER, the Holy One of Israel; I am JEHOVAH thy GOD which teacheth thee to profit, which leadeth thee by the way thou shouldst go," Isa. xlviii. 17 "With everlasting kindness will I have mercy on thee, saith JEHOVAH thy REDEEMER, Isa. iv. 8, "Their REDEEMER is strong, JEHOVAH OF HOSTS is His Name," Jer. 1. 4, "I am thy GOD from the land of Egypt, and thou shalt know no GOD but ME, for there is NO SAVIOUR BESIDE ME" Hos. xiii. 4, "Thus saith JEHOVAH, that formed thee O Israel, fear not, for I have REDEEMED THEE," Isa. xliii. 1, "Be strong, fear not; behold your GOD will come with vengeance, even GOD with a recompense, he will come and save you," Isa. xxxv. 4, "The LORD JEHOVAH is my strength and my song, he also is become my *salvation*," Isa. xli. 2, "Behold JEHOVAH GOD shall come with strong hand, and His arm shall rule for Him, He shall feed his flock like a shepherd," Isa. xl. 10-11. The Saviour lays claim to this title, John x. 11, "Let the words of my mouth, and the meditation of my heart, be acceptable in thy sight O JEHOVAH, my strength, and my REDEEMER," Ps. xix. 14, "But GOD shall REDEEM my soul from the power of the grave, he will receive me," Ps. xlix. 15, "I will also praise thee with the psalter, even thy truth, O my GOD; unto thee will I sing with the harp, O thou Holy One of Israel. My lips shall greatly rejoice when I sing unto thee; and my soul, which thou hast REDEEMED," Psa. lxxi. 22-23, "For GOD is my King, of old, working *salvation* in the midst of the earth," Psa. lxxiv. 12, "They remembered that GOD was their rock, and the high GOD their REDEEMER," Psa. lxxviii. 35, "I will praise thee O JEHOVAH my GOD, — thou hast *delivered my soul from the lowest hell*," Psa. lxxxvi. 12-13, "Bless JEHOVAH, O my soul, and forget not all his benefits, who *redeemeth* thy life from destruction; who crowneth thee with loving kindness and tender mercies," Psa. ciii. 2-4, "Let Israel hope in JEHOVAH, for with JEHOVAH there is mercy, and with him is plenteous *redemption*, and he shall *redeem* Israel from all his iniquities" Psa. cxxx. 7-8, "O GOD JEHOVAH, the *strength of my salvation*, thou hast *covered my head in the day of battle*," Psa. cxi. 7. By which is signified, humble acknowledgement that redemption, protection, and consequently deliverance from hell, are from the LORD alone, "O give thanks unto Jehovah, for he is good, for his mercy endureth forever, Let the *redeemed* of JEHOVAH say so, whom *he hath redeemed* from the hand of the enemy," Ps. cvii. 1-2, "JEHOVAH liveth; and blessed be my rock; and let the GOD of my *salvation* be exalted," Ps. xviii. 46, "And they remembered that GOD was their Rock, and the high GOD their REDEEMER," Ps. lxxviii. 35, "They forgot GOD their SAVIOUR, which had done great things in Egypt," Ps. cvi. 21, "The *salvation* of the righteous is of JEHOVAH; he is their strength in the time of trouble," "Truly in JEHOVAH our GOD is the *salvation* of Israel, Jer. iii. 23. In the New Testament, James calls our Blessed Redeemer, the "LORD of glory." The LORD of glory can be none other than the King of glory. "Who is this KING of glory? JEHOVAH of Hosts, he is the King of glory," Ps. xxiv. 10. In Rev. xix. 16, the LORD as to the Word, is described as having on his vesture and on his thigh, a name written, KING OF KINGS, AND LORD OF LORDS. This sacred truth is echoed by Paul when he declares Christ to be "The blessed and only Potentate, the King of Kings, and Lord of Lords, *who only* hath immortality," I. Tim. vi. 15. Elsewhere he says, "For of him, and by him, and through him are *all things*; to whom be glory for ever. Amen, "JEHOVAH thy GOD in the midst of thee is mighty, he WILL SAVE, he will rejoice over thee with joy," Zeph. iii. 17, "I will rejoice in JEHOVAH, I will joy in the GOD of my *salvation*," Hab. iii. 18, "I will look unto JEHOVAH, I will

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 er power of the
 e thee with the
 with the harp,
 hen I sing unto
 2-23, "For God is
 " Psa. lxxiv. 12.
 high God thy
 OVAH my GOD,
 vi. 12-13, "Bless
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 and by him, and
 men, "JEHOVAH
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wait for the God of *my salvation*; my God shall hear me" Micah. vii. 7,
 "The voice of him that crieth in the wilderness, Prepare ye the way of the
 JEHOVAH, make straight in the desert a highway for our God. Every valley
 shall be exalted, and every mountain and hill shall be made low," Isa. xl.
 34. "By which is signified, the mission of John the Baptist preparing the
 way for Christ's Advent by the preaching of repentance, baptism, and the
 remission of sins, at a time when there were no truths left in the Church,
 but what were falsified and made of none effect. By "every valley shall be
 exalted, and every mountain and hill shall be laid low," is not meant these
 natural objects but the exaltation into heaven of those who are meek and
 lowly in heart, or poor in spirit, and the removal and remission to their final
 abode of the wicked who have lived in the pride of self-love and the love of
 the world, for all such avert from themselves the divine protection, and are
 in conjunction with hell. The influx of divine truth flowing into
 their interiors, when the Lord comes to judgment, causes such exceeding
 pain and torment to the wicked, "that they actually cast themselves head-
 long into hell." That the Lord executed such a judgment when on earth,
 is most evident both from the literal and spiritual sense of many passages
 in the Word; reference will be made to some of them in what follows, and
 that the last judgment is retold in the Revelation, and many other places,
 has also taken place, may be seen proved in the writings to be mentioned
 presently. It is to be noted, however, that these general judgments do
 not take place in the natural world, but in the spiritual world, into which
 all enter after death, "after death the judgment." To continue, in the
 sublime vision described by Isaiah, chap. vi., the prophet relates that the
 seraphim cried, "Holy, holy, holy is JEHOVAH OF HOSTS, the whole
 earth is full of his glory." The message given to Isaiah at that time is
 quoted in John xii. 38, &c., where it is written, "These things spake
 Esaias, when he saw His glory, and spake of Him," and the apostle
 applies the whole as having reference to the Incarnate God in the person
 of the Blessed Saviour then on earth. The Hebrew term, JEHOVAH,
 retained in the above passages, is always expressive of self-existence, un-
 derived Being, and the Divine principle as to Love, while the term, God,
 is predicated of, and corresponds to, the Divine principle, as to Wisdom,
 or, what is the same, Truth, which always emanates or proceeds from
 the former, as light proceeds from fire or heat. It was as the Divine
 Truth, or the Word, that the Lord was made flesh and dwelt among
 us, but still he did not separate from Himself the Divine Good or Love,
 denoted by the Father. As previously stated, this existed in Him in but
 a comparatively small degree at the first, and glorification was a gradual
 work, extending over the whole of His earthly life, progressing only as
 what was merely human was cast out, or made "perfect through suffer-
 ings," until at last He comprehended in His glorious Person "all the
 fulness of the Godhead bodily," and became God even as to His Human-
 ity having all power in heaven and in earth." To have *all power* is to
 possess nothing less than exclusive and supreme Divinity, and notwith-
 standing the deplorable fact that this heavenly doctrine is not recognized
 in the prevailing Church, still it is the veriest truth in the universe, that
 He was the great Jehovah, or "God manifest in the flesh," [1 Tim. iii. 16],
 and also "over all, God blessed for ever," Rom. ix. 5, for "by Him were
 all things created that are in heaven and that are in earth, visible and
 invisible, whether they be thrones, or dominions, or principalities or
 powers; all things were created by Him and for Him, and He is *before all*
things, and by Him *all things* consist." Col. i. 16, 17. With all this
 evidence before us we may well unite with Jude in saying, "To the only
 wise God OUR SAVIOUR, be glory and majesty, dominion and power,
 both now and ever. Amen."

We may see from the above passages as in the very light of heaven, the
 great and glorious truth that the Blessed JESUS is JEHOVAH, THE GOD OF
 HEAVEN AND EARTH, THE LORD OF GLORY, THE FIRST AND THE LAST,
 THE MIGHTY GOD, THE EVERLASTING FATHER, THE CREATOR OF ALL
 THINGS, THE REDEEMER OF THE WORLD, GOD MANIFEST IN THE FLESH,
 THE KING OF KINGS AND LORD OF LORDS, OVER ALL, GOD BLESSED FOR
 EVER, A JUST GOD AND A SAVIOUR, BESIDES WHOM THERE IS NONE ELSE,
 AND AS SUCH IS ENTITLED TO OUR EXCLUSIVE LOVE AND ADORATION.—

And here we cannot omit noticing the ominous silence which pervades not only the above passages of Scripture, but also the entire Word, respecting the doctrine which we hear thundered forth from so many pulpits, regarding a Son of God born from eternity, called the Second Person of the Trinity, who came into the world in order to satisfy what is called the vindictive justice of the first Person, and appease his wrath and vengeance against the human race on account of the violation of his law of which they were guilty, by taking on himself that punishment, which would otherwise have descended on the sinner, the implication being, that the attributes and perfections of God the Father, rendered it impossible for him to forgive the sinner until the majesty of his outraged law was vindicated and satisfied to the uttermost, by the infliction of adequate punishment either on the innocent, or on the guilty. The great majority of professing Christians retain this belief, together with the doctrine of three distinct Persons in the Godhead, most of us having been educated in it from our infancy, and so are not to blame in consequence, more especially as these doctrines are usually held up as an inexplicable mystery which it is almost a profanation either to investigate or dispute. A man under such circumstances is not to blame for holding this belief in ignorance, simplicity and innocence, even although it is unscriptural, for he will be instructed in the real truth in the next world, if not in this, and if his heart is good he will receive it most gratefully, for goodness always desires truth and union with it. But, if, on the other hand, a man should say that since Christ obeyed the law for him and suffered in his room and stead, therefore he is at liberty to do as he pleases, and forthwith carries that thought into action by plunging into a career of *known evil* and wickedness, under the belief that everything will beset right at last by a simple cry for mercy, and a "LORD save me," uttered on his death bed, such a line of thought and consequent action would be *perfectly infamous*, and after death the ruling love of such a man will infallibly entail a righteous retribution by carrying him to his like in hell, and what is wonderful, he goes there of his own accord. The power and love of evil draws him there. This is what we are forewarned to fear, Luke xii. 5, "It is not God who sends him there, for it is impossible for Him who is Mercy itself, to damn any one. The 'LORD is good to all, and his tender mercies are over all His works,'" thus even to the lowest hell. The true reason is "Ye will not come unto me that ye may have life." "Your iniquities have separated between you and your God, and your sins have hid his face from you." To return to the question of the Trinity, as commonly received, it is impossible to suppress the enquiry, why is it that the second and third Persons of the Trinity, as described by this scheme (the attributes and perfections of each person being essentially the same), have not, or do not, put forth an equal claim with the first person, to full, perfect, and complete satisfaction on account of their violated law? Yet here we have them described as not only putting forth no such claims, but the second person is represented as coming forward and drinking the very dregs of the bitter cup of His Father's wrath, even to suffering the accursed death of the cross, and by this means satisfying or appeasing the so called Divine displeasure of the first person.

One Doctrine of that new Dispensator which cometh down from God out of heaven, drawn from the Word, is, that God is Mercy Itself and Love Itself, and that wrath, fury, anger and vengeance are as far removed from the Divine nature as heaven is from hell, yea, and infinitely farther. These are qualities which could not consistently be ascribed to a good man, because he would not be good if he possessed them, wherefore it is blasphemy to ascribe them to God. O when will mankind learn that it was *love, love, unutterable, Infinite Love*, that brought our Heavenly Father into the world to save and redeem His erring children at the very period when they were about to be engulfed in eternal ruin through the undue preponderance of the powers of hell over mankind. Most true it is that "God so loved the world that he gave his only begotten Son that whosoever believeth in him should not perish, but have everlasting life," John iii. 16, most true that "In His love and in His pity he redeemed us," Isa. xlii. 9, for "God was in Christ reconciled and reconciling guilty sinners to Himself," being moved to that infinite condescension by a "love which passeth knowledge," Eph. iii. 19. Zacharias spoke

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the truth when he said, "Blessed be the LORD GOD of Israel, for He hath *visited and redeemed* His people," Luke 1. 68; also aged Simeon, when he said, "LORD, now lettest thou thy servant depart in peace, according to thy word, for mine eyes have seen thy salvation," Luke 11. 29-30. This was said of the only Begotten Son of God (born of the virgin) in whom was the Father, of whom it was written, "Behold a virgin shall conceive and bear a son, and shall call his name Immanuel," Isa. vii. 14. Yes, joyful thought, He was indeed and now is, GOD WITH US, so that all can say "Lo, this is our God, we have waited for Him, we will be glad and rejoice in His salvation." The sufferings of Christ were great, beyond all human comprehension, and they were endured solely on our account and for our salvation, but not to satisfy or appease the wrath of any one, but to satisfy His own Divine Love, for that desires nothing in comparison with man's salvation, and that it may communicate all its fulness of joy and unspeakable delight to every soul it has created. It is thus that "God commendeth His Love toward us, in that while we were yet sinners Christ died for us," Rom. v. 8. And not only so, but "we also joy in God through our LORD JESUS CHRIST, by whom we have now received the atonement," ver. 11. It is thus seen that it is not who received the atonement, not God, as is commonly supposed. It is man who went astray; became wicked, and thus became an enemy and needed reconciliation, at-one-ment, or being brought at-one or in agree-ment with his Maker. And this that Infinite Love that never slumbers nor sleeps has been incessantly endeavouring to do ever since man declined from goodness, for it followed him step by step in his downward career, until at the very moment when hell was about to claim him for her own, the great JEHOVAH assumed the Humanity, thus supplying the last link of the golden chain which was thenceforward to unite God more closely to His erring children, and enable Him to become their Saviour. In this Humanity He encountered the powers of hell, and executed a judgment in the spiritual world, on those infernal hosts who were infesting and obsessing mankind, the indwelling Divinity sustaining the Humanity, and enabling it to overcome in the midst of combats, temptations and sufferings so dreadful that it is impossible for the mind of man to conceive of them, among the last being the temptations in the garden, and on the cross. Many of these combats are described in the internal sense of the word in the following, and many other places which cannot be mentioned here by reason of their abundance: Ps. xviii. xxii., xxxv., xl. 1, 2, v. 1, 6, lxix., cii. 11, 1., cxxx., 1, 2., Isa. liii., lix., 16, 19, lxiii. 1, 6., lxiv. 1, 13., Mal. iv., 1, 3., Matt. iv. 1., 10 xxvi. 38, 44, Mark 13, Luke xxii., 42, 44, John xiv 30, xvi. 33. In these passages the temptations, combats, and victories referred to are described in a Divine manner by mere correspondences, each possessing an internal or spiritual meaning. These are some of the ways in which the "kindness and love of God our Saviour toward man appeared," Titus iii. 4, "This is the true God and eternal life," 1 John v. 20, and the Beneficent Being whose kindness we are exhorted to imitate, "by forgiving one another even as God in Christ hath forgiven us," Ephes. iv. 32. This is the right translation of the passage. In the English Bible it reads, "even as God for Christ's sake hath forgiven you," but this sense is unscriptural, and does not exist in the original. The prevalent custom of asking mercies from God for Christ's sake is the result of ignorance regarding the true God in the mind of the worshipper, who in such a case is actually thinking of two or three Gods, although he does not say so with his lips. "Save us for Thy name's sake," and "Redeem us for Thy mercies sake," are common expressions in the Word. The great JEHOVAH, whom we have seen to be none other than CHRIST Himself, says "I, even I, am He that bloteth out thy transgressions for mine own sake," "Whatsoever ye ask in my name, I will do it," and thus it always is.

The question will now be asked, if these statements are true, how does it come that wrath, anger, and vengeance are so frequently ascribed to God in the Word? The answer is that these expressions contain *appearances of truth*, but not the *real truth*. Many things are thus expressed in the Word. It speaks of the rising of the sun and the going down of the same, because it appears to do so. It tells us to pluck out our right eye

and cut off our right hand, if they offend us. It tells us to take no thought for our life, what we shall eat, or what we shall drink, or for our body, what we shall put on. Does any man in his senses act thus? It tells us that it is almost impossible for a rich man to enter heaven. It tells us that Christ came not into the world to promote peace on the earth, but rather division, when nevertheless He is the Prince of Peace. It tells us that unless a man hates his father, and mother, and wife and children, and brothers, and sisters, yea, and his own life also, he cannot be Christ's disciple. Every one knows that these expressions are not to be understood literally, and so it is in the case of anger, wrath, and vengeance when such qualities are ascribed to God, but it is most true that to the wicked he *appears* to be invested with such attributes. The children of Israel are described as an evil and perverse generation who did always err in their heart, and knew not the ways of JEHOVAH, Ps. xcv. 10. Their vine is described as the "vine of Sodom and of the fields of Gomorrah; their grapes are grapes of gall and their clusters are bitter; their wine is the poison of dragons, and the cruel venom of asps," Deut. xxxii. 32-33. By these correspondences is described a most intense degree of wickedness, as pertaining to the interiors of that people. We find in consequence of this, that at the giving of the Law on Mount Sinai, that "the glory of JEHOVAH was like devouring fire in the eyes of the children of Israel," Ex. xxiv. 17. On the other hand, when Moses and Aaron, Nadab and Abihu and seventy of the elders of Israel (seventy, as well as seven, in the Word, are numbers which are expressive of holiness, or what is good or sacred), ascended into the mountain, "they saw the God of Israel; and there was under his feet, as it were, a paved work of a sapphire stone, and as it were the body of heaven in clearness," ver. 10. Now mark the contrast, the great JEHOVAH was seen under these various aspects altogether according to the *state* of the different spectators. It was only the "wicked and slothful servant," who possessed the "evil eye" by which he perceived his Lord to be "a hard man, reaping where he had not sown, and gathering where he had not strewed," Matt. xxv. 24. From this cause proceeds the cry of the wicked to the mountains and rocks, "Fall on us, and hide us from the face of Him that sitteth on the throne, and from the wrath of the Lamb," Rev. vi. 16. The sole cause of his dreadful appearance to them, lay in themselves, not in God, thus confirming the Divine words, "With the merciful thou wilt shew thyself merciful; with an upright man thou wilt shew thyself upright; with the pure thou wilt shew thyself pure; and with the froward thou wilt shew thyself froward," Ps. xviii. 25-26. Thus, when the Word declares that the LORD is gracious, and full of compassion, slow to anger and of great mercy, and says further, "Fury is not in me," it expresses a *real* truth, but when in the letter of the Word, wrath and anger are ascribed to God, only involves an *apparent* truth, for the internal sense of the Word teaches, and the regenerated heart of every child of God will tell him, that the "Lord is good, that His mercy is everlasting, and that His truth endureth to all generations." It is most true in every case that it is "evil which slays the wicked," for the DIVINE LOVE most intensely desires to elevate all to heaven, and would do so in every case, if man would only make use of that free will, with which it has endowed him, to choose life and goodness, (for man's willing co-operation in this case is indispensable), and thus suffer himself to be led by the LORD into heaven. The powers of evil are continually pressing for admission into man, desiring nothing more than to destroy him soul and body, and are continually restrained from accomplishing their infernal work by nothing less than infinite power, but when infinite wisdom, or the Divine providence, perceives that the removal of the wicked is necessary for the preservation of the good, the law of permission can no longer be withheld, and evil agents perform the evil work, and this actually *appears* to be as if done by the LORD, and is so expressed in the Word. "He slew famous kings, for His mercy endureth for ever," "He sent evil angels among them," and so on. Many other things are described in the Word according to appearances, such for instance as the LORD repenting, being grieved at the heart, &c., the internal sense of these expressions being very different from what appears in the letter.

We will now proceed to conclude the grateful task of shewing that the BLESSED JESUS is the only ONLY TRUE Object of worship, and as such, ought to be recognized in the Church, and by every human being. In doing this we do not anticipate any objections from professed Christians, when we say that it would be quite safe to emulate the example of the Apostles on earth and that of the angels in heaven. After our Blessed Redeemer had ascended up on high, it is written, that he sat down "on the right hand of God." By this is signified, that He even as to His Humanity took possession of Divine Omnipotence, having "all power given unto Him in heaven and in earth," for in Him dwelt all the fulness of the Godhead bodily, Col. ii. 9.

After the ascension, it is written concerning the disciples, "And they worshipped him, and returned to Jerusalem with great joy." We read further that "they lifted up their voice with one accord and said, LORD thou art GOD, which hast made heaven and earth, and the sea, and all that in them is," Acts iv. 24. And Stephen died, "calling upon God, and saying, LORD JESUS receive my spirit," Acts vii. 59.

Concerning worship in heaven, we read that "the four and twenty elders [by whom are signified the superior angelic powers], fell down before Him that sat on the throne and worshipped Him that liveth for ever and ever, and cast their crowns before the throne saying, Thou art worthy O LORD to receive glory and honour and power; for thou hast created all things and for thy pleasure they are and were created," Rev. iv. 10, 11. Chapter v. ver. 10 records that "the four beasts and four and twenty elders, [signifying the hosts in the superior heavens], fell down before the Lamb, and gave utterance to the sublime glorification recorded in ver. 9. 10. "And they sung a new song, saying, Thou art worthy to take the Book and to open the seals thereof; for Thou wast slain, and hast redeemed us to God by Thy blood out of every kindred, and tongue, and people, and nation; and hast made us unto our God kings and priests, and we shall reign on the earth." "And they sung a new song," signifies an acknowledgment and glorification of the LORD, that He alone is the Judge, Redeemer and Saviour, thus the GOD of heaven and earth. These things are contained in the song which they sung, and the things they contain are also signified: as an acknowledgment that the LORD is the Judge in this: "Thou art worthy to take the Book and to open the seals thereof." That He is the Redeemer in this, "For Thou wast slain, and hast redeemed us to God by Thy blood," that He is the Saviour in this, "Thou hast made us unto our God kings and priests, and we shall reign on the earth," by which is signified, that from the LORD they are in wisdom from divine truths, and in love from divine good, for all such are spiritual kings and priests, and will be in His kingdom, He in them, and they in Him: that He is the GOD of heaven and earth, in this: "They fell down and worshipped Him that liveth for ever and ever," see ver. 14. Since the acknowledgement of the LORD alone as the GOD of heaven and earth, and of the Divinity of His Humanity, and that in no other way could He be called a Redeemer and Saviour, was not before in the Church, it is called a *new song*. After this it is recorded that ten thousand times ten thousand and thousands of thousands, were heard saying, with a loud voice, "Worthy is the Lamb that was slain, to receive power: and riches, and wisdom, and strength, and honour and glory, and blessing," denoting confession and glorification from the heart, by the angels of the inferior heavens, that to the LORD's Divine Humanity belong Omnipotence, Omniscience, divine good, divine truth, and all felicity, "And every creature which is in heaven, and on the earth, and under the earth, and such as are in the sea, and all that are in them heard I saying, Blessing, and honour, and glory, and power, be unto Him who sitteth upon the throne, and unto the LAMB for ever and ever," ver. 13. By which is signified, confession and glorification by the angels of the lowest heavens, that in the LORD from eternity and thence in His Divine Humanity, is the all of heaven and the church, divine good, and divine truth, and divine power, and from Him in those who are in heaven and the church, "After this I beheld, and lo a great multitude which no man could number, of all nations, and tribes, and tongues, stood before the throne and before the LAMB, clothed with white robes and palms in their hands; and cried

with a loud voice, saying, "Salvation to our GOD that sitteth upon the throne, and to the LAMB," chap. vii. 9, 10. To cry with a loud voice signifies an acknowledgment from the heart that the LORD is their Saviour. "Salvation to our GOD that sitteth upon the throne, and to the LAMB," signifies that the LORD is Salvation itself, and that the salvation of all is from Him, thus that He is their Redeemer and Saviour. By Him that sitteth upon the throne, and the LAMB is meant the LORD alone; by Him that sitteth upon the throne His Divinity from which He came forth; and by the "LAMB," His Divine Humanity. That one Being is meant, may be seen confirmed by ver. 17, where the LAMB is described as being in the *midst* of the throne. "And all the angels stood round about the throne, and about the elders and the four beasts, and fell down before GOD on their faces and worshipped GOD, saying, Amen, blessing and glory and wisdom, and thanksgiving, and honour, and power, and might, be unto our GOD for ever and ever, Amen," ver. 11, 12. By this great company is signified, all in the universal heaven; "And fell before the throne on their faces and worshipped GOD," signifies, the humiliation of their heart, and from humiliation, adoration of the LORD. "Blessing, and glory, and wisdom, and thanksgiving," signifies the divine spiritual things of the LORD; "And honour and power and might," signifies the divine celestial things of the LORD; "Be unto our GOD for ever and ever," signifies these things in the LORD, and from the LORD to eternity. "And there were great voices in heaven, saying, The kingdoms of the world are become the kingdoms of our LORD and of His Christ, and He shall reign for ever and ever," Rev. xi. 15, signifies, celebration by the angels, because heaven and the Church are become the LORD's as they were from the beginning, and because they are now in subjection also to His Divine Humanity, consequently that now, both as to His Humanity and Divinity, the LORD will reign over heaven and the church to eternity. "And the four and twenty elders, that sat before GOD on their thrones, fell on their faces, and worshipped GOD," ver. 16, signifies an acknowledgment by all the angels of heaven, that the LORD is the GOD of heaven and earth, and supreme adoration; saying, "We give thee thanks, O LORD GOD ALMIGHTY, who art, who wast, and who art to come," ver. 17, signifies a confession and glorification by the angels of heaven, that it is the LORD who is, who has life and power from Himself, and who rules all things, because He alone is eternal and infinite; "because thou hast taken thy great power and hast reigned," ver. 17, signifies the new heaven and the new Church where they acknowledge Him to be the only GOD. "And they sing the song of Moses, the servant of GOD, and the song of the Lamb," Rev. xv. 3, 4, signifies, a confession grounded in charity, and in a life according to the commandments of the Law, which is the decalogue, and in a belief in the Divinity of the LORD's Humanity; saying, "Great and marvellous are Thy works, LORD GOD ALMIGHTY," signifies that all things in the world, in heaven, and in the Church were created and made by the LORD, from divine love by Divine Wisdom. "Just and true are Thy ways, Thou King of saints," signifies, that all things which proceed from Him are just and true, because He is divine good and divine truth in heaven and in the Church; "Who shall not fear thee, O LORD, and glorify thy name," signifies, that He alone is to be loved and worshipped; "For Thou only art holy," signifies that He is the Word, the truth and the illumination. "For all nations shall come and worship before thee," signifies, that all who are in the good of love and charity, will acknowledge the LORD to be the only GOD. "For Thy judgments are made manifest," signifies, that the truths of the Word plainly testify it. "And a voice came out of the throne, saying, Praise our GOD, all ye His servants, and ye that fear Him," Rev. xix. 6, signifies, influx from the LORD into heaven and consequent unanimity of the angels, that all who are in the truths of faith and goods of love should worship the LORD as the only GOD of heaven. "Both small and great," signifies, those who in a greater or lesser degree worship the LORD from the truths of faith and goods of love. "And I heard as it were the voice of a great multitude, and as the voice of many waters, and as the voice of many thunders, saying, Alleluia! for the LORD GOD OMNIPOTENT reigneth," ver. 6, signifies, the joy of the angels of the

lowest heaven, of the angels of the middle heaven, and of the angels of the highest heaven; because the LORD alone reigns in the Church which is now about to come, signified by the Bride the LAMB's wife, or the new Jerusalem mentioned in ver. 7, 8, and chap. xxi. 2.

In order to banish all doubt as to who is meant by the term "God," in these passages, we now quote the testimony of the BLESSED JESUS in Rev. xxi. 6, 7: "And He said unto me, It is done," signifies that it is Divine truth. "I am Alpha and Omega, the Beginning and the End," signifies, that the LORD is the GOD of heaven and earth, and that all things in the heaven and earth were made by Him, and are governed by His Divine Providence and done according to it. "I will give unto him that is athirst of the fountain of the water of life freely," signifies, that to those who desire truths from any spiritual use, the LORD will give from Himself through the Word, "He that overcometh shall inherit all things; and I will be his God, and he shall be my son," signifies, that they who overcome evil in themselves, that is, the devil, or the love of self and the world, and do not yield or sink in temptations, will go to heaven, and there live in the LORD and the LORD in them. This is the testimony of JESUS. Let it be supplemented by the testimony of the angel: "Fear not; for behold I bring you good tidings of great joy, which shall be to all people. For unto you is born this day in the city of David, a SAVIOUR, which is CHRIST THE LORD," Luke ii. 10, 11. That our Blessed LORD received divine honours and worship when on earth may be seen, Matt. ix. 18, xiv. 83, xv. 28, xxviii. 9, Mark i. 40, v. 22, vii. 25, x. 17, Luke xvii. 15, 16.

It is known from the science of correspondences that such meanings are actually involved in the above mentioned passages of Scripture, yea, and much more, for each expression being from a Divine origin embodies within itself infinitely more than man or angel can ever comprehend. But we have seen enough to convince us that the LORD is in very deed the supreme GOD of heaven and earth, in whom is the Divine Trinity of Father, Son and Holy Spirit. "Now the LORD is that Spirit, and where the Spirit of the LORD is, there is liberty," 2 Cor. iii. 17. Go then, my friend, to this Saviour GOD, who once for your sake became "a Man of sorrows and acquainted with grief," serve Him by obeying His commandments, draw near to Him at all times with humility, love, and faith unfeigned, for He will have mercy, and you will "hear a word behind you, saying, This is the way, walk ye in it," Isa. xxx. 21. Confide in Him during every trial and under every difficulty, and you will indeed find that the eternal GOD is thy refuge, and that underneath thee is the everlasting arms. In every weak and doubtful state He will impart strength by laying "His right hand upon you, saying, Fear not, I am the First and the Last," Rev. i. 17. Let us act thus and the time will be present concerning which it is written: "And the LORD shall be King over all the earth; in that day there shall be one LORD and His name ONE," Zec. xiv. 9.

Such is the Doctrine of the LORD as taught in the Word, and such was the doctrine held by the apostles and the primitive Christian Church (as may be seen by consulting the writings of the early Fathers), until the time of the council, convened at Nice, in Bithynia, by command of the Emperor Constantine, A.D. 325. This was called for the purpose of repressing the Arian heresy, and a creed, the first that ever recognized the existence of *three distinct Persons* in the Trinity, was drawn up by Hosius of Corduba, at the instance of this council, and hence was called the Nicene Creed. What is called the Athanasian Creed came out about a century later, but it is now known that Athanasius never composed it. The assertions and claims of this last mentioned document are really astounding, and none can be ignorant of the powerful efforts put forth in England by all classes of the people, among them the very highest dignitaries of the English Church, to exclude it from the liturgy.

From the doctrine of Three Persons in the Godhead as taught by these creeds, flow many other doctrines equally inimical to truth, as for instance, that God the Father imputes the merit and righteousness of His Son to those who believe that he died for them, and that Christ having obeyed the law in our room and stead, we are thereby exempted from all

obligation to obey it except as an outward rule of life, thus nullifying and making of none effect the spirituality of those commandments of which it is said, that "if a man do, he shall live in them," Levit. xviii. 5.

It is certainly true that man has, and can have, no goodness or righteousness but what emanates from the Lord alone, from which ground He is called "JEHOVAH OUR RIGHTEOUSNESS," Jer. xxxiii. 16. It is also true that the Lord's method of imparting this righteousness involves continual warfare against evils as sins, on the part of man, for goodness can only enter as evils are expelled, but this is a very different thing from the imputation of the Lord's merit and righteousness, which is divine, infinite, and eternal, for it is no more possible to ascribe, impute, or adjoin, what is divine, infinite and eternal to any human being, than it is to clothe him with the attributes of Omnipotence, and empower him to create a universe. It would be like plunging him into a furnace heated sevenfold, which would consume him in a moment. The righteous Lord can never recognize any righteousness in a man which has not been implanted in his life. Christ says, that He "shall reward every man according to his works," Matt. xvi. 27, Rev. ii. 23, xx. 12, 13, xxii. 12. It is never said according to his belief, but according to his works. "And it shall be our righteousness if we observe to do all these commandments before JEHOVAH our GOD, as He hath commanded us," Deut. vi. 25. "I command thee this day to love JEHOVAH thy GOD, and to keep His commandments and His statutes and His judgments, that thou mayest live," Deut. xxx. 16. "Ye shall command your children to observe to do all the words of this law. For it is not a vain thing for you, because it is your life," chap. xxxii. 46, 47. Concerning the violation of His law it is written, "O that they were wise, that they understood this, that they would consider their latter end," ver. 29. And in Isaiah: "O that thou hadst hearkened to my commandment, then had thy peace been as a river, and thy righteousness as the waves of the sea," chap. xlvi. 18, "I will recompense them according to their deeds, and according to the works of their own hand," Jer. xxv. 14. "Thine eyes are open upon all the ways of the children of men, to give to every one according to his ways, and according to the fruit of his doings," xxxii. 19, "He hath shewed thee, O man, what is good; and what doth JEHOVAH require of thee but to do justly, to love mercy, and to walk humbly with thy God," Micah vi. 8. "According to our ways and according to our doings, so hath he dealt with us," Zech. i. 6, "Every one who heareth these sayings of mine and doeth them, I will liken him unto a wise man who built his house upon a rock—and every one who heareth these sayings of mine and doeth them not, shall be likened unto a foolish man who built his house upon the sand," Matt. vii. 24, 26, "And why call ye me LORD, LORD, and do not the things which I say," Luke vi. 46, "They that have done good shall come forth to the resurrection of life," John v. 29, "If ye know these things, happy are ye if ye do them," John xiii. 17, "Herein is my Father glorified, that ye bear much fruit," John xv. 8, "If ye keep my commandments ye shall abide in my love," v. 10, "Ye are my friends if ye do whatsoever I command you," v. 14, "He that hath my commandment, and keepeth them, he it is that loveth me," xiv. 21, "Circumcision is nothing and uncircumcision is nothing, but the keeping of the commandments of God," 1 Cor. vii. 19, "For this is the love of God that we keep His commandments, and His commandments are not grievous," 1 John v. 3, "Ye see then how by works a man is justified and not by faith only," James ii. 24. When it is said "that a man is justified by faith, without the deeds of the law," Rom. iii. 28, we are to understand this passage as having sole reference to the law of outward circumcision and external washings and purifyings, which being merely representative rites, were abolished by the coming of Christ, see v. 30, Acts xvi. 1-24. In what was written to the seven churches in Asia (by whom is represented the Church of Christ as to every possible state), the Searcher of hearts states in each and every case, "I know thy works," and rewards are promised to those who overcome evils in themselves, or, what is the same, obey the commandments. These rewards are described in a figurative manner by correspondences, which in the internal sense are significative of every variety of heavenly joy, and supreme felicity.

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Every man is born into the world with evil propensities and depraved inclinations, derived from a long line of ancestors. These propensities and inclinations, are not imputed to man as sins, because they have been inherited through hereditary transmission, and thus he cannot prevent them. But these depraved affections are the avenues through which infernal agencies flow in as a flood and tempt man by the insinuation of evil desires and wicked thoughts, and it is just here where man's responsibility begins. If he, by virtue of the free will given him by God, compels himself [and in this compulsion there exists the highest freedom], to resist and abhor these evil desires and thoughts, and turns from them as accursed and abominable, and does that which is just and right, he obeys the commandments, and saves his soul. If, on the other hand, he does not restrain himself, but yields to temptation, if in his heart he thinks that evil is permissible, even though he does not actually carry it out to the extreme of actual perpetration, for want of opportunity, or through fear, or other causes, in this case he makes it his own by loving it, and doing it whenever he can, and thus disobey the commandments which say that evils are not to be done. "He who is willing to be saved, must confess his sins and do the work of repentance. To confess sins is to know evils, to see them in himself, to acknowledge them, to make himself guilty, to condemn himself on account of them; when this is done before God, it constitutes the confession of sins. To do the work of repentance is to desist from sins, when he has thus confessed them, and from an humble heart to make supplication concerning remission, and it is further to lead a new life according to the precepts of faith."

As to what has been alleged in the above statements concerning the nature of every man born into the world, even our adorable Redeemer was no exception. He, "the Lamb of God which taketh away the sin of the world," did no sin, neither was guile found in His mouth." But for the sake of man's salvation, he assumed the Humanity, at the very lowest and darkest hour of its existence, with all its infirmities, inclinations to evil, and liability to temptation and suffering, derived from a long line of ancestry, through Mary. In no other way could the Saviour be said to bear the sins of mankind, as it is written, "Surely He hath borne our griefs, and carried our sorrows; yet we did esteem him stricken, smitten of God, and afflicted. But he was wounded for our transgressions, he was bruised for our iniquities; the chastisement of our peace was upon him; and with his stripes we are healed,—and the Lord hath laid on him the iniquity of us all," Isa. liii. 5, 7. These hereditary evils in the form of the love of self and the world, were the channels through which the powers of darkness assaulted Him in temptations a thousand times more grievous than any man could possibly sustain, and these evils, together with the whole infernal crew, He overcame and vanquished by means of His own proper power, through the indwelling Divinity. From this ground He said to His disciples: "The prince of this world cometh, and hath nothing in me," Be of good cheer, I have overcome the world," "I beheld Satan, as lightning, fall from heaven," "To him that overcometh will I grant to sit with me on my throne, even as I also overcame," Rev. iii. 21.

In no other way could he become a Saviour than by assuming the Humanity, and thus coming nearer the same plane as that of the spiritual enemies of mankind, for in His absolute Divinity, God is a consuming fire, unapproachable by any angel, much less by an infernal spirit. By temptations, sufferings and continual victories over evil, He overcame principalities and powers, triumphing over them on His cross, glorified His Humanity and made it Divine, and is now exalted a Prince and a Saviour to give repentance and remission of sins. In His Divine example, every child of God may see that his duty is plain to take up his cross and follow his Blessed Lord in the regeneration.

It may now be visible to all who are willing to see, that the scripture contains a spiritual as well as a natural sense, and that it is pervaded by a union of good and truth, or love and wisdom, the instances in which this is the case being so numerous that in order to adduce them all, it would be necessary to transcribe the entire Word. It may be further seen in what manner the science of correspondences serves to unfold the spiritual

sense of the Word, but great difficulty has been felt from want of space to illustrate each topic by parallel passages from the Sacred writings, and I am most reluctantly compelled to omit the notice of thousands of other matters which would be most highly instructive, for there is nothing mentioned in the Scriptures, not even the smallest jot or tittle, but what is pregnant with divine wisdom, and this by reason of the solemn truth, that in the inmost of the Word, the LORD ALONE IS. Even in the historicals of the Word, such as the journeys of the Israelites, we have a perfect counterpart of the journey of every Christian from the Egypt of a natural state, to his triumphant entry into the heavenly Canaan, together with the whole arcana of his regeneration, all written by the finger of GOD, and described by mere correspondences. The first chapters of Genesis, apparently descriptive of the creation of the natural universe. Adam and Eve, the garden of Eden, the tree of life, and of the knowledge of good and evil, the serpent, Cain and Abel, the flood, Noah, and the other patriarchs, the ark, the tower of Babel, etc., down to the end of the eleventh chapter of Genesis, will be found, when interpreted by the science in question, to contain the most wonderful embodiment of divine truth: ever unfolded to the world. This science will enable us to harmonize every apparent discrepancy in the letter of the Word, and understand all passages which are otherwise inexplicable, and is not such a study deserving of the attention of every one, since in these latter days, the LORD GOD the Saviour has been most graciously pleased to disclose the knowledge of it, so that what has hitherto lain most deeply concealed is now made manifest in the clearest light, and the transcendent importance of the disclosure is such that this is in very truth what is denoted by "the Son of Man coming in the clouds of heaven," which was to take place at the consummation of the age, or church, erroneously translated, "end of the world." These revelations and disclosures have been made through a man whom the LORD raised up, prepared, instructed, and filled with His spirit, so that he might reduce them to writing, and that thus they might be printed and preserved for the use of His church through succeeding generations. That man was Emanuel Swedenborg, and these unfoldings of the spiritual sense of the Word are to be found in his theological writings, to which I would refer all who take delight in the study of the scriptures, for no lover of truth can fail to be both delighted and astonished, at the profundity and variety of the immense mass of knowledge presented in relation to the spiritual sense of the Word, heaven and hell, and the life of man after death. The subjects so imperfectly treated in this brief sketch, and many thousands besides, will be found in those writings to be treated with the full measure of that elaborate justice which they deserve. Every sentence seems to confirm and verify their author's claim that he was called and prepared for this holy office by the LORD Himself, for most assuredly nothing short of supernatural illumination could enable any one to make such statements, and impart such knowledges as are contained in these books. The exalted pleasure derived from the study of these writings is the sole reason for recommending them to the consideration of others, and I take much pleasure in appending the names of the different books, with a few collateral works, together with the addresses of responsible parties from whom they may be procured. See list on last page. The theological writings would fill about thirty octavo volumes of 500 pages each, and his philosophical works, written anterior to his illumination, would fill as much more, making about sixty volumes in all. It is deemed proper to state that the writer has no pecuniary interest in the sale of these books, the parties whose addresses are given on the last page having at this time, March 1873, no intimation whatever, that any such notice as this is intended; furthermore, what has been adduced in this appendix has been done from a love of the truth, and from no desire for emolument of any kind.

The illustrious Swedenborg, who died March, 29, 1772, was a Swedish nobleman, held in high respect by the royal family of Sweden, and was certainly one of the most extraordinary and learned men who ever lived. The celebrated chemist Berzelius, says of Swedenborg's "Animal kingdom:" "I have been surprised to find how the mind of Swedenborg has preceded the present state of knowledge, writing his work at the time he did." The Rev. John Clowes of Manchester, England, writes as follows,

"The author of this memoir cannot conclude his narrative without offering up to the Father of mercies his most devout and grateful acknowledgments, for the extraordinary privilege and inestimable blessing vouchsafed him in having been admitted to the knowledge and acknowledgement of the truth and importance of the doctrines unfolded by Swedenborg from the Word of God as the genuine doctrines of christianity." This gentleman translated Swedenborg's largest work, the "*Arcana Cœlestia*," in ten octavo volumes, from the Latin into English. Professor Gorres of Germany, writes as follows, "Throughout the entire career of his learned researches and activity, we everywhere discover the pious and religious man, who in all his sayings and doings, was intent upon good," Dr. Gabriel A. Boyer, professor of Greek literature in Gottenburg, in a long declaration respecting the doctrines taught by Swedenborg, delivered in obedience to the royal command, Jan 2nd., 1772, concludes thus, "*I have found in them nothing but what closely coincides with the words of the Lord Himself, and that they shine with a light truly divine.*" Gen. Christian Tuxen, a personal acquaintance of Swedenborg's, and Commissioner of War under the King of Denmark, states in a letter, "For my part I thank our LORD the God of heaven, that I have been acquainted with this great man and his writings; I esteem this as the greatest blessing I ever experienced in this life." The Rev. Dr. Hartley, late Rector of Whitwick, Northamptonshire, England, the translator of Swedenborg's "*Heaven and Hell*," writes thus, "I have found him to be the good divine, the good man, the deep philosopher, the universal scholar, the polite gentleman; and I further believe that he had a high degree of the Spirit of God, and was commissioned by Him as an extraordinary messenger to the world." Let the enquirer after further evidence procure the "*Documents concerning Swedenborg*," compiled by Dr. Tafel and Professor Bush, and he will find a volume filled with evidence similar to this. The "*Statement of Reasons for embracing the Doctrines and Disclosures of Emanuel Swedenborg*," by Prof. Bush, will also prove of great interest. The "*True Christian Religion*" is a good work for beginners, being the last written by Swedenborg. In it he says, "The particulars of faith on man's part are, 1. That God is one, in whom there is a Divine Trinity, and that He is the LORD God and Saviour JESUS CHRIST. 2. That saving faith is to believe on Him. 3. That evil actions ought not to be done because they are of the devil, and from the devil. 4. That good actions ought to be done, because they are of God, and from God. 5. And that a man shall do them as of Himself, nevertheless under this belief, that they are from the LORD, operating with him and by him. The first two particulars have relation to faith; the next two to Charity; and the last respects the conjunction of charity and faith, and thereby of the LORD and man. In his "*Doctrine of Life*" he states, "All religion has relation to life, and the life of religion is to do good." Elsewhere he states, "There are five classes of those who read my writings. The first reject them entirely, because they are in another persuasion, or because they are in no faith. The second receive them as scientifics, or as objects of mere curiosity. The third receive them intellectually, and are in some measure pleased with them, but whenever they require an application to regulate their lives, they remain where they were before. The fourth receive them in a persuasive manner, and are thereby led, in a certain degree to amend their lives and perform uses. The fifth receive them with delight, and confirm them in their lives." Dear reader, to which class will you belong? The following "*Rules of Life*," were found among the writings of this great and good man. 1. Often to read and meditate on the Word of God. 2. To submit everything to the will of the Divine Providence. 3. To observe in everything a propriety of behaviour, and to keep the conscience clear. 4. To obey that which is ordained, to be faithful in the discharge of the duties of our employment, and to do everything in our power to render ourselves as universally useful as possible. His motto, "*THE LORD WILL PROVIDE*."

Regarding the happiness of heaven, we quote the following from the writings of this illumined author.

"It is said in heaven, that innocence dwells in wisdom, and that the angels have wisdom in proportion as they have innocence. That this is the case they confirm from these considerations: That they who are in a

state of innocence attribute nothing of good to themselves, but consider themselves only as receivers and ascribe all to the LORD; that they are desirous to be led by him, and not by themselves; that they love every thing which is good, and are delighted with every thing which is true, because they know and perceive that to love what is good, thus to will and do it is to love the LORD, and to love what is true is to love their neighbour; that they live contented with what they have, whether it be little or much, because they know that they receive as much as is profitable for them, little if little be profitable, and much if much, and that they themselves do not know what is profitable for them, because this is known only to the LORD, who hath a view to what is eternal in all the operations of His providence." "All who are in the good of innocence are affected by innocence, and so far as any one is in that good, so far he is affected. The inmost principles of heaven are two, viz., innocence and peace. They are termed inmost principles, because they proceed immediately from the LORD. Innocence is that principle from which is derived every good of heaven, and peace is that principle from which is derived all the delight of heaven. Every good is attended with delight; and both good and delight have relation to love; for whatever is loved is called good, and is perceived as delightful; hence it follows, that those two inmost principles, innocence and peace, proceed from the divine love of the LORD, and affect the angels from an inmost ground." "The divine sphere of peace in heaven flows from the LORD, and exists in consequence of His conjunction with the angels of heaven, and in particular in consequence of the conjunction of good and truth in every angel. These are the origins of peace, whence it may be evident that peace in heaven is the Divine sphere inmost affecting with blessedness every principle of good there, thus acting as the source of all the joy of heaven; and that in its essence it is the joy of the LORD's divine love, resulting from His conjunction with heaven and with every one there. This joy perceived by the LORD in the angels, and by the angels from the LORD is peace. Hence, by derivation, the angels have every blessedness, delight and happiness, or that which is termed heavenly joy." "Every one may know, that when man leaves the external or natural man he comes into the internal or spiritual; whence it may be known that heavenly delight is internal or spiritual, but not external or natural; and since it is internal and spiritual, that it is purer and more exquisite, and that it affects the interiors of man, which are the faculties of his soul or spirit," "The delights of heaven are ineffable, and likewise innumerable. But of those innumerable delights not one of them can be known or credited by him who is in the mere delight of the body or of the flesh; since his interiors look away from heaven and towards the world, that is, backwards. Wherefore a person of this description would wonder greatly, if he were only told that there are delights existing when the delights of honor and gain are removed; and still more if he were told, that the delights of heaven succeeding in their place are innumerable, and are such that the delights of the body and the flesh, which are chiefly the desires of honor and gain, cannot be compared with them. Hence, the reason is evident, why it is not known what heavenly joy is." "The angelic life consists in use, and in doing good works from charity. For nothing is more delightful to the angels than to instruct and teach spirits coming from the world, to serve mankind by inspiring them with what is good, and by restraining the evil spirits attendant on them from passing their proper bounds, to raise up the dead to eternal life, and afterwards, if their souls be of such a quality as to render it possible, to introduce them into heaven. In the performance of these offices they perceive an indescribable degree of delight. Thus they become images of the LORD; for they love their neighbour more than themselves, and where this feeling exists, there is heaven. Angelic happiness, then, is in use, from use, and according to use, or, in other words, it is perceived during the performance of the good offices of love and charity." "Heavenly joy itself, such as it is in its essence, cannot be described, because it has its seat in the inmost grounds of the life of the angels, and thence in every particular of their thoughts and affections, and from these again in every particular of their speech and actions. It is as if the interiors were fully expanded to the reception of delight and blessedness, which is diffused

But consider that they are every love every which is true, us to will and e their neigh- it be little or profitable for at they them- is known only erations of His re affected by affected. The ace. They are tely from the every good of the delight of od and delight od, and is per- most principles, ond, and affect re of peace in e His conjunc- sequence of the the origins of o Divinesphere od there, thus its essence it is njunction with the Lord in the by derivation, or that which is man leaves the ritual; whence iritual, but not that it is purer t, which are the re ineffable, and not one of them at of the body or and towards the description would s existing when more if he were e are innumera- flesh, which are red with them. heavenly joy is." ks from charity. nstruct and teach oirning them with it on them from al life, and after- possible, to intro- ces they perceive o images of the selves, and where then, is in use, perceived during "Heavenly joy because it has its d thence in every so again in every teriors were fully which is diffused

into all the fibres, and thus through the whole angel; whence its perception and sensation are such as to admit of no description; for what communications from the inmost parts, flows into all derived from them, and propagates itself with continued augmentation towards the exteriors. Good spirits who are not as yet in that delight, because not as yet raised up into heaven, when they perceive it emanating from an angel by the sphere of his love, are filled with such delight that they fall as it were into a swoon, through the sweetness of the sensation." "That I might know what is the nature of the delights of heavenly joys, it hath been granted me by the LORD to perceive them; wherefore, since I have had living experience, I can know, but not at all describe them; yet something shall be said to give some idea of them. It was perceived that the joy and delight came as from the heart, diffusing themselves with the utmost softness through all the inmost fibres with such a sense of enjoyment, that the fibre is as it were nothing but joy and delight; and in like manner every perception and sensation thence derived, receiving its life from happiness. The joy of bodily pleasures, compared with these joys, is as a gross and pungent clot compared with a pure and most gentle aura. It was observed that when I was desirous to transfer all my delight to another, a more interior and fuller delight flowed in its place, and it was perceived that this was from the LORD."

Regarding the punishments of the wicked we extract the following from "*Heaven and Hell*."

"Evil spirits are severely punished in the world of spirits, that by punishments they may be deterred from doing evil. This appears as if it were from the LORD, when yet nothing of punishment comes from the LORD but from evil itself. *For evil is so conjoined with its own punishment that they cannot be separated.* The infernal crew desire and love nothing more than to do evil, especially to inflict punishment and torment; and they likewise do evil, and inflict punishment on every one who is not protected by the LORD; wherefore, when evil is done by any from an evil heart, since this rejects from itself all protection from the LORD, infernal spirits rush in upon him who does it and punish him"—What infernal fire is—which is mentioned in the Word as the portion of those who are in hell, hath as yet been known scarcely to any one, by reason that mankind have thought materially respecting the things mentioned in the Word, not being acquainted with its spiritual sense, wherefore by this fire some have understood material fire, some torment in general, some the pangs of conscience, and some have supposed that it is mentioned merely to impress the wicked with terror." "The spiritual heat appertaining to man is the heat of his life, because in its essence it is love. This heat is what is meant in the Word by fire, love to the LORD and neighbourly love being meant by heavenly fire, and self love and the love of the world being meant by infernal fire; and since such lust possesses all who are in the hells, therefore, likewise when the hells are opened, there is seen a sort of fiery appearance, with smoke issuing from it, such as is usually seen from buildings on fire. But when these are closed, this fiery appearance is not seen, but in its place an appearance like a dark mass of condensed smoke. It is however to be noted, that they who are in the hells are not immersed in fire, but that the fire is an appearance, for love corresponds to fire and all things which appear in the spiritual world appear according to correspondences." "As by infernal fire is meant every lust to do evil flowing from the love of self, by it is also meant torment such as has place in the hells. For the lust derived from that love is the lust of hurting others who do not honor, venerate and pay court to the subject of it; and when such lust prevails in every one, in a society which is restrained by no external bonds such as the fear of the law, and of the loss of reputation, of honor, of gain, or of life, every one under the impulse of his own evil, rushes upon another, and so far as he prevails, enslaves the rest and reduces them under his dominion, and from a principle of delight exercises cruelty towards those who do not submit. All the hells are such societies; wherefore every one there bears hatred in his heart against another, and from hatred bursts forth into cruelty, so far as he prevails." "As rebellious disturbances constantly exist there, since every one there desires to be greatest, and burns with hatred against others hence come

new outrages. Thus one scene is changed for another; wherefore they who had been made slaves are taken out to help some new devil to subjugate others; when they who do not submit, and yield implicit obedience, are again tormented by various methods, and so they go on continually. Such torments are the torments of hell, which are called internal fire. Besides these general miseries, in the first volume of the *Arcana Cælestia* are described a number of specific inflictions which follow the perpetrators of various crimes.

Concerning the medium of salvation, we quote from the *Apocalypse Explained*, No. 803, "It is known that faith grounded in love is the essential medium of salvation, and that hence it is the chief thing of the doctrine of the Church, but inasmuch as it is of importance to know how man may be in illustration, so as to learn the truths which must constitute his faith, and in affection so as to do the goods which must constitute his love, and then may know whether his faith be the faith of truth, and his love the love of good, this will be shewn in its order; which is this, 1. Let a man read the Word every day, one or two chapters, and learn from a competent teacher and from preachings, the doctrines of his religion; and especially, let him learn that God is one, that the Lord is the God of heaven and earth (John, iii, 35; Chap. xvii. 2, Matt, xi, 27; Chap. xxviii. 18.); that the Word is a life, that there is a heaven and a hell, and that there is a life after death. 2. Let him learn from the Word, from a competent teacher and from preachings, what works are sins, and that they are especially adulteries, thefts, murders, false testimonies, and several others mentioned in the decalogue; likewise that lascivious and obscene thoughts also are adultery; that frauds and illicit gains also are thefts; that hatreds and revenges also are murders; and that lies and blasphemies also are false testimonies; and so on. Let him learn all these things as he advances from infancy to adolescence. 3. When man begins to think from himself, which takes place after the age of adolescence; it must then be the first and primary thing with him, to desist from doing evils, because they are sins against the Word, thus against God; and that if he does them, he cannot have eternal life, but hell; and afterwards as he advances in years, to shun them as accursed, and turn away from them even in thought and intention. But in order to desist from them, and shun and become averse to them he must supplicate the Lord for aid. The sins from which he must desist and which he must shun and become averse to are principally adulteries, frauds, illicit gains, hatreds, revenges, lies, blasphemies, and pride, and self-conceit. 4. In proportion as man detests those things by reason of their being against the Word, and thence against God, in the same proportion communication is given him with the Lord, and conjunction is effected for him with heaven; for the Lord enters, and with the Lord heaven, as sins are removed; for these and their falses are the sole hindrances. The reason is, because man is set in the midst between heaven and hell, wherefore hell acts from the one part, and heaven from the other in proportion therefore as evils are removed which are from hell in the same proportion goods from heaven enter, for the Lord says, 'Behold I stand at the door and knock; if any man shall hear my voice, and open the door, I will come in to him.' Rev. iii. 20. But if man desists from doing these evils from any other cause than because they are sins, and against the Word, and thence against God, conjunction with heaven is not effected for him, because he desists from himself, and not from the Lord. The Lord is in the Word, inasmuch that He is called the Word, John i. 1, 2, 3, 4. because the Word is from Him; that hence there is conjunction of heaven with the man of the Church by the Word, may be seen in the work concerning *Heaven and Hell*, No. 303 to 310. So far then as man detests those sins, so far good affections enter, as, for example, so far as he detests adulteries, so far chastity enters; so far as he detests frauds and unlawful gains, so far sincerity and justice enter, so far as he detests hatred and revenges, so far charity enters; so far as he detests lies and blasphemies, so far truth enters, and so far as he detests pride and self-conceit, so far enters humility before God, and the love of his neighbor as himself, and so on; from hence it follows that to shun evils, is to do goods. 6. So far as man is in these good affections, so far he is led of the Lord, and not of himself, and so far as he acts from them, so far he does good.

works ; because he does them from the LORD and not from himself ; he then acts from charity, from sincerity and justice, from charity, from truth, in humility before GOD, and from these no one can act of himself. 7. The spiritual affections which are bestowed by the LORD on the man who is in those principles, and acts from them, are the affection of knowing and understanding the truths, and goods of heaven and the church, together with the affection of willing and doing them ; likewise the affection attended with zeal of fighting against falses and evils, and dissipating them with himself and with others ; hence man has faith and love, and hence he has intelligence and wisdom. 8. Thus, and not otherwise, is man reformed ; and so far as he knows truths, and wills and does them, so far he is regenerated, and from natural becomes spiritual, in like manner his faith and his love.

If vils are not removed because they are sins, all things which man thinks, speaks, wills and does, are not good nor true before GOD, however they appear as good and true before the world ; the reason is, because they are not from the LORD, but from man, for it is the love of man and of the world, from which they are and which is in them. Most people of this day believe, that they are all come into heaven if they have faith, live piously, and do good works ; and yet they do not hold evils in aversion because they are sins, whence they either commit them or believe them to be allowable, and they that believe them to be allowable, commit them when opportunity is given ; but let them know that their faith is not faith, that their piety is not piety, and that their good works are not good, for they flow from the impurities which lie inwardly concealed in man, the external deriving all their quality from the internals ; for the LORD says, " Thou blind Pharisee, cleanse first the inside of the cup and platter, that the outside may be clean also, Matt. xxiii. 23 ; from these considerations it may now be evident, that if man should fulfil all things of the law, if he should give much to the poor, if he should do good to the fatherless and the widow, nay if he should also give bread to the hungry and drink to the thirsty, gather the sojourners, clothe the naked, visit the sick, go to the bound in prison ; if he should preach the gospel strenuously, convert the Gentiles, frequent temples, hear preachings with devotion, attend the sacrament of the supper frequently devote time to prayer, with more such things, and his internal is not purified from hatred and revenge, from craftiness and malice, from insincerity and injustice, from the filthy delight of adultery, from the love of self and the love of ruling thence derived, and the pride of self-intelligence, from contempt of others in comparison with himself, and from all other evils and the falses thence derived ; till all these works are hypocritical, and are from the man himself and not from the LORD. But on the other hand, those same works, when the internal is purified, are all good, because they are from the LORD with man ; who cannot otherwise than do them, because he is in the faith and love of doing them." — " These are the works, which are understood in the Word by works, which can by no means be separated from faith, for faith separated from them is dead, and dead faith is a faith of what is false from an evil love, or is the thought that a thing is so, whilst the life is still evil." — " That to abstain from evils from any other cause whatever, than from the Word, does not purify the internal man, is evident from the origin of evil works and from the origin of good works ; as he who abstains from adulteries from fear of the civil law and its punishments, from fear of the loss of fame and thence of honor, from fear of hurt arising from poverty, covetousness or avarice ; from fear of sickness from them, and consequent intranquility of life, from infirmity arising from abuse, or from age, or even from natural good and the moral principle thence derived, as not being becoming and proper, &c., and from these causes alone lives chastely, still he is internally unchaste and an adulterer, if he does not abstain from them out of spiritual faith, which faith is, that adulteries are infernal, because they are contrary to the Divine Law, and thence contrary to the fear of GOD, and the love of the neighbour. And so in all other cases."

As many may desire further information respecting doctrines which are silently but surely finding their way with transforming power among all classes of Christians, I will now insert in their order, 1. Who are these new Church people? by Rev. Dr. Bayley of London. 2. The Ribband of

Blue, from "The Divine Word Opened," by the same author, intended to illustrate the correspondence of garments, colors, &c., in the Word. 3. The substance of an interview held at No. 20, Cooper Union, New York, by a *Sun* Reporter. 4. List of Swedenborg's theological writings, together with the names of a few valuable collateral works which will be found well worthy of perusal.

WHO ARE THESE NEW CHURCH PEOPLE ?

The frequency with which the sentiments unfolded in the writings of Swedenborg, and others in illustration of them, are met with from time to time, impels many inquiring minds to ask the question above recorded, and has induced the information to be given which is afforded in the following dialogue :—

Q. Who are these New Church people ?

A. They are Christians who believe that the higher culture and greater progress of the world towards light, charity, and peace, depend upon a closer communion with the Lord Jesus Christ, as the all in all to His Church, God over all, in Whom dwells all the fulness of the Godhead bodily.

Q. But why do they call themselves Swedenborgians ?

A. They do not call themselves Swedenborgians ; but **NEW CHURCHMEN**, or Christians of the New Jerusalem Church. They esteem very highly the writings of Swedenborg, who was an illustrious servant of the Lord Jesus. By the truths in his writings they have been greatly profited ; they find themselves assisted to draw nearer to the Saviour, to understand the Scriptures more thoroughly, and perceive their wondrous Divinity. These writings also contain much concerning the laws and circumstances of the eternal world.

Q. But what is this about the New Jerusalem : Do they think a great golden city is to come down to the earth through the clouds ?

A. Not in the least. These outward wonders and spectacles in the skies they leave to others. They understand that sentiments golden and clear are to enter men's minds. They only expect the world to become nearer like heaven, as new principles of light, love, and justice, become more fully received, and extensively spread among men. They believe thoroughly the words of the Lord Jesus, "The kingdom of God cometh not by outward observation ; neither shall men say, lo here ! nor, lo there : But the kingdom of God is within you" (Luke xvii. 21). We can make our little world happier to-day if we will. And the whole world must learn to become wiser, and will and strive to become better, and so the Lord will become king over all the earth (Zech. xiv. 9.)

Q. But why do they talk of anything new on such subjects ? How can there be anything new in religion ? Christianity is old enough, and if they are Christians how can they be new, *New Church*, or anything of that kind ?

A. Religion, though always pure at first, when revealed from the Lord, has a great tendency to become corrupt, in time, by the self-seeking dispositions of worldly Christians, who hope to acquire pelt and power by making religion popular, and debasing it by popular errors and human traditions, rather than by elevating the people to justice, judgment, and the love of God. So the Jews made the commandments of God of none effect by their traditions. So Christianity, by corruptions commencing in the time of Constantine, became a mass of mysteries and superstitions. The first great error was a God said to be of three separate Divine persons, and then the worship of Mary as a semi-divine person. Next came praying to a host of dead men, and caring more for their bones and relics than for keeping the commandments of God. The Scriptures were sent up away from the people until the time of the Reformation, and though in this country and America we have the Scriptures fully now, many of the leading corruptions of dark times remain. These perversions and evils, which united with, and others which arise out of them, make religion old and bring it to an end ; then the Lord Jesus reveals eternal truths afresh and calls them new ; they are new to us. It is written in relation to

these times, He who sat upon the throne said, BEHOLD, I MAKE ALL THINGS NEW (Rev. xix. 6).

Q. What are these new principles you speak of? Tell in the first.

A. It is new; yet it is truly old. It is that Jehovah, the eternal God, our Creator, is absolutely one, and He became our Saviour, Jesus Christ. So that in Jesus Christ is the first and the last, the human and the Divine, the Father, the Son, and the Holy Spirit, the eternal Trinity. He is all in all to us, the Father is in Him as the soul is in the body.

Q. Yet Christ prayed to the Father?

A. That was while He was in the world in times of temptation, while He had our nature, with its infirmities and imperfections, and He had to teach us how to suffer and to pray. The human prayed to the Divine, as our lower nature appeals for succour to our better nature in times of distress. It seems to us, in deep trials, as if there were two persons in us; but they are not two persons, and when the trial is over and perfection attained, then there is entire unity. So when Christ's trials were over and His humanity was glorified, there was no praying to the Father, but He was manifestly the Father in the Son (John xiv. 13). He who sees Him sees the Father (John xiv. 7, 8, 9). He is the everlasting Father and the Prince of Peace (Isa. ix. 6). He is the root and the offspring of David, the bright and the morning Star (Rev. xxii. 16). He is the Sun of righteousness (Mal. iv. 2). The Bread of Life (John vi. 48). The Light of the world (John ix. 5). The King of kings and Lord of lords (Rev. xix. 16). Come to Him, pray to Him, follow Him, serve Him.

Q. But how about the Atonement?

A. Christians of the New Jerusalem believe in the Atonement as the Apostle Paul expresses it, God was in Christ reconciling the world unto Himself (2 Cor. v. 1). He reconciled it to Himself first in His own Humanity (John xvii. 19; Eph. ii. 16). He has been reconciling it ever since by His Gospel, and He will reconcile it to Himself in us if we will repent, turn to Him, and become new men.

Q. Is there not something peculiar about the way of viewing the Bible?

A. We have precisely the same Bible that you have, but the New Church declares the Bible to have a spiritual meaning, over and above the literal meaning; not denying the literal meaning, but using it for history, for doctrine, and for edification, as other Christians do. The spiritual meaning constitutes a Bible within the Bible, always treating of the Church, the regeneration of the soul, of the battles we wage against our sins, and of the things of heaven. But this is only what the Saviour said, My words, they are spirit and they are life (John vi. 63); the apostles declare the same thing. The letter killeth, but the spirit giveth life (2 Cor. iii. 6).

Q. But how about the early chapters of Genesis?

A. Up to the history of Abraham, they are Divine allegories, full of spiritual wisdom, clothed in the language of parable, in the manner of that most ancient literature that was the origin of the Egyptian hieroglyphics, and the beautiful fables of the Greeks. Hence there is no contradiction between this part of the Bible and geology. Natural creation is the emblematical account of moral and spiritual creation.

Q. Is a man, according to these views, saved by FAITH ALONE in the merits of his Saviour?

A. He must have faith in the merit of his Saviour, and he has no merits of his own. But he must also BELIEVE, LOVE, and do his Saviour's will, or he cannot be prepared for heaven. In religion, love is the great principle, the root of all the rest (Rom. xiii. 8, 10; Matt. xxii. 37, 40). The Apostle Paul said, Now abideth these three, faith, hope and charity (or love), and the greatest of these is charity (or love). (1 Cor. xiii. 13).

He who loves the Lord Jesus, will BELIEVE His words, and do His commandments. Faith alone is dead, the apostle said (James ii. 26); whether it is in the merits of our Saviour, which are truly infinite, or anything else. The FAITH which loves and works is the only faith which saves.

Q. How is a heavenly character formed?

A. First, by a conviction of our sinfulness, then by repentance and prayer. Next, by perseverance in well-doing, by confident faith in the Lord Jesus, faithfulness in the times of trial and temptation; by daily

reading of the Word of God, and prayer, and by the diligent use of the means of grace. Thus the tastes and aims of life become entirely altered, and the soul delights in heavenly things as its chief joy.

Q. What then is the New Churchman's RULE OF LIFE ?

A. Precisely that taught in the Old and in the New Testament by the Lord Jesus and His apostles : namely, in humility, faith, and love to keep the Ten Commandments. What doth the Lord thy God require of thee, but to do justly, love mercy, and walk humbly with thy God ? (Micah vi. 8). Jesus said, If ye love me, keep my commandments (John xiv. 15). The Apostle Paul wrote, Circumcision is nothing, and uncircumcision is nothing, but KEEPING THE COMMANDMENTS OF GOD (1 Cor. vii. 19) ; and John declared This is the love of God, that we keep His commandments : and His commandments are not grievous (1 John v. 3).

We must keep the Divine precepts in all the employments, engagements, habits, and acts, of DAILY LIFE ; without that, our belief is vain, and our religion self-deception.

Q. Can this be done by a man's own strength and merit ?

A. No man has any strength or any merit, but what comes from God, every moment of his life. But God our Saviour does give strength to every one who truly seeks Him. He also gives His angels charge to aid us from our birth to our grave. And they lovingly receive us and welcome us when we die.

Q. Are all children who die taken to heaven ?

A. Oh, certainly. Angels of love, who have been their guardian angels take them into their blessed care in heaven, train them in love and wisdom, and thus lead them to enjoy the full bliss of their heavenly home.

Q. Do people know each other after death, who have known each other in the world ?

A. Certainly, and they will continue together, if their states agree and will permit.

Q. Is there any other especial feature of the principles of this New Church ?

A. Yes ; the very high and sacred character it attributes to marriage. This holy institution is regarded as one for which the Creator has formed the sexes in mind and body, and should be entered upon only with those who are constantly striving to overcome self, to live for heaven as well as for earth, and who shun sins against purity, as the deadliest of sins.

Q. How does this Church regard the Resurrection ?

A. Every person has a spiritual body as well as a natural body (1 Cor. xv. 44). This spiritual body becomes more beautiful by regeneration, or more ugly by sin. Flesh and blood, as the Apostle says, cannot inherit the kingdom of God (1 Cor. xv. 50). The body thou sowest is not the body that shall be (v. 37). But the angelic Christian mind has a heavenly body, for God giveth it a body as it hath pleased Him, and to every seed his own body (v. 38). Absent from the earthly body, he is present with the Lord (2 Cor. v. 8). Evil persons have a spiritual body as ugly as they are vicious. Both are fitted at death for the worlds to which they go : and the dust returns to the dust whence it was. All the parts of the Gospel which treat of the resurrection of man, mean the resurrection of the soul from the death of sin, and the grave of corruption, to the life of righteousness and spiritual health (John v. 24, 25 ; Eph. v. 2, 5). It is not this scriptural view far more sensible than to imagine that all who have died are without bodies, until the scattered dust of bodies which had *every hour been changing during life*, and had been taking new forms in the vegetable world, been eaten by animals, and then become parts of other human bodies, for no one knows how many thousands of years, is brought together again ?

Q. But cannot God's omnipotence do this ?

A. God never uses His omnipotence to do what is foolish and wrong. We have no warrant to call in God's power to justify our blunders. Whatever God does is the BEST thing, done in the WISEST WAY.

Q. When and where does judgment take place ?

A. The true Christian judges himself from day to day. But, after death, he appears before the judgment seat of Christ in the spirit world, which is an intermediate state between heaven and hell. After death the judgment (Heb. ix. 27).

Q. Is there much said in Scripture about this intermediate state, or world of judgment and instruction ?

A. Very much. It is the world the prophets saw in vision, or when their spiritual eyes were opened (Numb. xxiv. 16; 2 Kings vi. 17) John in the Revelations describes what he saw in that world through all its chapters ; heaven was above him—the bottomless pit below him.

Q. But what, then, is meant by the judgment at the end of the world ?

A. The end of the world, in the original Greek of the Scriptures, is the end of the AGE or DISPENSATION ; and when a Church has been for ages corrupt, the bulk of the people have been cherishing mistaken principles, and in many things doing wrong the greater part of their lives, as in disliking and hating others that were not of their own Church, and supposing that it was right all the while. These cannot be so soon introduced as in former times, either to heaven or to hell, and great numbers gather and remain in the spirit world, the world of judgment. But, at the end of the age, all are judged, and a new age or new dispensation is begun in the world. The end of the world means the end of a dispensation, not the end of the universe (Ps. lxxv. 8 : Isa. xxiv. 16, 19)

Q. Then is not the natural world to come to an end at all ?

A. Certainly not. According to Scripture, the world and the universe will endure for ever (See Eccles. i. 4 ; Ps. lxxii. 5, 17 ; lxxviii. 69 ; civ. 5 ; cxlviii. 6 ; xciii. 1 ; xcvi. 10).

Q. What, then, do you understand by the second coming of our Lord in the clouds of heaven ?

A. He has been banished from His Church by grievous errors and evil practices. He comes nearer when men receive His truth in love and obey Him. He comes nearer in the fuller opening of His Word. He comes in truer principles into the hearts and minds of men. He comes by the extension of His truth into all the ways and works of men. Light is like the inward glory of the Bible ; the clouds mean the outward language of the Bible, through which an inner glory shines. He comes in clouds when He makes Himself known to men in the language of His Word, which is plainly there revealing the true character of Himself, His will, and His kingdom, though they had forgotten or ignored it. All the writers of the Bible are called a cloud of witnesses (Heb. xii. 1). Those who take the letter without the spirit are said to be clouds without water (Jude 12). The Lord comes in the clouds of heaven when He applies His Word to the hearts and minds of men ;—in power and great glory, when He reveals the power of His Word and the great glory of His kingdom. Behold, I stand at the door and knock ; if any man will open the door, I will come in to him, and sup with him, and he with Me. The kingdoms of this world shall become the kingdoms of our Lord and of His Christ, and He, as One Divine Person, shall reign for ever and ever. (Rev. xi. 15.)

Q. What is taught as to heaven and hell ?

A. Very much, so that the laws of both may now be fully understood. Heaven is formed of the heavenly-minded, who have been made such by regeneration, more or less perfectly done on earth. The heavenly ones are arranged in most perfect order, by the laws of divine love and wisdom ; or in our Father's house there are many mansions (John xiv. 2.) Hell is composed of those who have made hell upon earth ; they take themselves, their passions, and their lusts with them into pain and sorrow. The rage, the hate, the torment, the misery they excite and inflict upon one another is the hell-fire in which they live. The never-dying worm is the symbol of their low, grovelling selfishness ; it is their worm (Mark ix. 14), not God's. The wicked create their fire, they keep it alive themselves (Isa. ix. 18 ; l. 11) ; the false and insane thoughts of every kind which they conceive, and in which they live, make the utter darkness of their abode, of which the Saviour speaks. (Matt. xxii. 13.)

Q. Do you use the two sacraments instituted by our Lord, of Baptism and the Holy Supper ?

A. Oh certainly, and we see a sacred and most edifying meaning in each of them. Baptism we administer in the name of the Father, Son, and Holy Spirit, as a dedication of the person baptized to the service of the Lord Jesus, and the water is a symbol of that LIVING TRUTH which is the

Water of Life, and by which the soul is to be purified. The Bread and the Wine in the holy Supper, are the symbols of the goodness which our Lord calls the **BREAD OF LIFE**, and the Wisdom which he calls the "**NEW WINE OF THE KINGDOM**." When we sincerely receive these, we receive Him. We eat His **FLESH** and drink His **BLOOD**, and have **ETERNAL LIFE**.

Q. But do you think that other Christians have not truth as well as you; and that no one can be saved but those who join your communion?

A. Certainly not. There is much truth in every denomination of Christians, especially among those who possess and read the Word of God with diligence and prayer. We believe, moreover, that every one, will be saved who loves God, and strives to do His will in shunning evil and doing good according to what in his heart he believes to be true, whether he be of the Church of England, whose pious and learned clergy, notwithstanding many exceptions, we revere and admire, whose Prayer Book, with serious doctrinal defects, has many excellencies, and whose reverence for the Word of God is her chief glory; or worthy zealous Protestant Dissenters, or good Roman Catholics, good Jews, or Gentiles. Those who love God and work righteousness according to the best of their knowledge, will be relieved of their errors after death, and form part of the sublime fold in heaven, of which our Saviour speaks. "Other sheep have I that are not of this fold, them also must I bring, that there may be **ONE FOLD** and **ONE SHEPHERD**" (John iv. 14). The Apostle Peter spoke very clearly on the same point when he said, "Of a truth I perceive that God is no respecter of persons; but in every nation he that feareth God, and worketh righteousness, is accepted of Him." (Acts x. 34, 35).

Q. Is it, then, of no importance whether we belong to a true religion or a false one; whether we believe truth or error?

A. It is only truth, in any system, that does a person good, but there is much truth attached to every religion. Error is always a hindrance and a detriment. Truth is clear and full of comfort. Error is obscure, perplexing, and leads to distress. Truth is daylight. Error is a fog. It is because we believe the Lord has given at this time abundance of truths which are far from being generally acknowledged, which are edifying, delightful, and strengthening to us, that we wish all around us, both men and Churches, to accept them, and be strengthened and blessed also, so that the will of God may more perfectly be done upon earth, as it is done in heaven.

Dear reader, would you possess a scriptural, spiritual, rational, saving religion to aid you in your walk towards heaven, come and hear these Christians of the New Jerusalem, let them be called Swedenborgians, or what you like. Do you wish to see mankind issuing out of superstition, sectarianism, rationalism, narrowness, and darkness, into the glorious liberty of the children of light, then come and hear. Do you wish to see goodness and truth extending their sacred influence, and sin and folly shown to be the disorderly, brutal, coarse, and worthless things they are, then come and hear.

We address you in the language of Moses to Jethro. We are journeying unto the place of which the Lord said, I will give it you: come with us, and we will do you good; for the Lord hath spoken good concerning Israel. And it shall be, if you go with us, yea, it shall be, that what goodness the Lord shall do unto us, the same will we do unto thee. (Numb. x. 29, 32).

THE RIBBAND OF BLUE.

"Speak unto the children of Israel, and bid them that they make them fringes in the borders of their garments throughout their generations; and that they put upon the fringe of the borders a ribband of blue: And it shall be unto you for a fringe, that ye may look upon it, and remember all the commandments of the Lord, and do them."—NUMB. XV. 38, 39.

It is extremely to be regretted that so many who bear the name of Christian, have the most inadequate view of religion. To many it is but a name. They call themselves by the name of this or that great body, but ask them what they think of the principles which the name implies, and

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great body, but
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and the name, and little besides. Others, again, seem to think that
is an excellent debating-ground, a favorite battle-field. They
warily wrangle and dispute about its everlasting principles, but
state like upon them, and practise them less. These are like the left-
handed men of Benjamin among the Israelites of old, who "could sling
stones at an hairbreadth and not miss." They are not of much use except
in war. Far more eloquently and convincingly does he speak for his
religion, whose life pleads for it; who shows that he derives from it
virtue and defence, consolation and strength, light and blessing; and
therefore recommending it in deed, can also recommend it in word. "Ye
are our epistles," said the apostle, "known and read of all men."

Perhaps we cannot give a more comprehensive definition of religion,
than to say it is the supply to the soul of all its spiritual wants. It is the
soul's home, its food and its clothing; and to this latter feature, its being
clothing for the soul, we now entreat your attention. "Blessed," it is
written, "is he that watcheth and keepeth his garments, lest he walk
naked, and they see his shame."—Rev. xvi. 15.

That garments, even in the Jewish law, are the corresponding symbols
of those principles which clothe the soul, may be inferred from the laws
which we frequently find in relation to them. Unless there was a spiri-
tual sense in them, surely it would not have been worthy of the High and
Lofly One who inhabiteth eternity to give directions in relation to what
kind of clothes men should wear. There is the direction not to wear a gar-
ment of woollen and linen together; again, for a woman not to wear
a garment of a man; again, for a man's garment not to be kept
in pledge after the sun has gone down; and now the law before us, that a
fringe should be made to the garment, and on the fringe a ribband of
blue. Surely it cannot concern the Infinite Ruler of all worlds what kind
of trimming His people have to their dress, or color of ribband they have
thereon.

The soul and its concerns are surely the only appropriate objects of a
Revelation from the Eternal Father of immortal beings. To teach us
how to give the spirit a dress, so that it may be beautiful in the sight of
angels, is worthy of him who clothes Himself with light as with a garment
[Ps. civ. 2]. "I counsel thee to buy of me gold tried in the fire, that thou
mayest be rich; and white raiment, that thou mayest be clothed, and that
the shame of thy nakedness may not appear."—Rev. iii. 18.

The chief use of clothing is defence against the chills and variations of
the weather; two subordinate uses are for the promotion of beauty, and
for distinction of office.

We can be at no loss to perceive that there are mental uses correspond-
ing to the above which require for the soul spiritual clothing. The soul
has its summer and its winter, and all the varieties of a mental year.
There are seasons of hopefulness and brilliancy, in which we have all the
elasticity and promise of spring; there are states of peaceful warmth, of
continued serene happiness; "the soul's calm sunshine and the heartfelt
joy" which bespeak the spirit's summer; but there are likewise periods
of decreasing warmth, of incipient depressions, and coolness to what has
formerly yielded the highest pleasure; until at length we arrive at states
of painful chill, and even of intensest cold, the joylessness, the hopeless-
ness, and the sadness, which are the attendants of the winter of the soul.

This depressed condition of the spirits is portrayed with graphic truth-
fulness by one who said—

"My years are in the yellow leaf,
And all the life of life is gone;
The worm, the canker, and the grief,
Are mine alone."

And in a sweeter spirit of piety, by another poet—

"O for a closer walk with God,
A sweet and heavenly frame;
A light to shine upon the road,
Which leads me to the Lamb."

Where is the blessedness I knew
 When first I saw the Lord ?
 Where is the soul-refreshing view
 Of Jesus, and his Word ?

"What peaceful hours I once enjoyed
 How sweet their memory still ;
 But they have left an aching void
 The world can never fill."

In this wintry state, storms of distressing fears and darkening doubts will rush upon the soul. Strong delusions, that we may believe a lie, will like fierce tempests, howl about us. Cold, harassing, cheerless frames of mind, dispiriting anxieties, filling us with discomfort and dread ; bitter self-accusations urged upon us, perhaps by "spiritual wickedness in high places," like pitiless hail-storms which come upon us again and again, all teach us how real it is that the soul has its winter as well as its summer. In relation to these spiritual seasons it is written, "And it shall be in that day, that living waters shall go out from Jerusalem : half of them toward the former sea, and half of them toward the hinder sea ; in summer and in winter shall it be."—Zech. xiv. 8.

Thrice happy are they who remember, the living waters of the Divine Word will be a comfort and a blessing in joy and in sorrow, in sickness and in health, in summer and in winter ; but they should also bear in mind, that, to be a protection in all seasons, the Divine Mercy has provided us with spiritual clothing.

The DOCTRINES of religion, when intelligently adopted and adapted to our particular states, serve this important purpose. And when those doctrines are as they ought to be, full, comprehensive, and complete, applying themselves to all the departments of human affection, thought, and life, they make a complete dress. Hence it is said in Isaiah, "I will greatly rejoice in the Lord, my soul shall be joyful in my God ; for he hath clothed me with the garments of salvation, he hath covered me with the robe of righteousness, as a bridegroom decketh himself with ornaments, and as a bride adorneth herself with her jewels."—Isa. lxii. 10.

The doctrines which teach the true character of the Lord, His infinite and unchanging Love, His unerring and all-comprehensive Wisdom, His omnipotent and ever-orderly Power, these form the clothing for the head. The doctrines which teach and impel us to our duty to our neighbor, form the clothing to the breast : while those which teach that our religion should be operative, and descend to inspire and sanctify every word and every deed of life : these are the remainder of the spirit's dress, even to the "shoes upon the feet."

With this view of the spiritual dress of the Christian, we shall see the fullest significance in many interesting portions of the sacred Scriptures. When the prodigal son returned, we are informed ; "The father said unto his servants, Bring forth the best robe, and put it on him ; and put a ring on his hand, and shoes on his foot,"—Luke xv. 22, where it is manifest that the clothing of a newly-penitent spirit with those sacred truths which will form its best robe, that assurance of everlasting love which conjoins it to its Lord as a golden marriage-ring, and those true principles of virtuous practice which are the only bases of real religion, are the shoes upon the feet.

A most important lesson is afforded to us by the Divine Word in Matthew. It is said of those who came in to partake of the wedding feast of the King of heaven, "And when the king came in to see the guests, he saw there a man which had not on a wedding garment ; and he said unto him, Friend, how camest thou in hither, not having a wedding garment ? And he was speechless. Then said the king to the servants, Bind him hand and foot, and take him away, and cast him into outer darkness ; there shall be weeping and gnashing of teeth"—xxii. 11—13. No one can imagine that there was any ~~son~~ in a particular earthly dress not being had by those who enter the Lord's kingdom. But in a spiritual point of view, nothing can exceed the value of the intimation it contains. The kingdom of heaven, in fact everything heavenly, is the result of a mar-

riage. Wisdom sweetly blends with love to form the heavenly state. It is not a kingdom of faith alone, but of faith united to charity. No cold knowledge is tolerated there, but must be conjoined with affection for what is known. All is union in an angelic mind. All heaven is united to its Divine Head, the Lord Jesus Christ. The marriage order reigns complete, and joy is the result. "Thou shalt no more be termed Forsaken; neither shall thy land any more be termed Desolate; but thou shalt be called Hephzibah, and thy land Beulah; for the Lord delighteth in thee, and thy land shall be married."—Isa. lxi. 4.

Not to have on a wedding garment, then, is not to have a doctrine which unfolds this glorious union of truth and love in religion, and in heaven. It is to be practically among those who say, and do not. It is to make a parade of our piety and profession, it may be, but to neglect that, without which piety is nothing, faith is nothing, doctrine is nothing, name is nothing; that pure and holy love, which worketh, which hopeth, which believeth all things; which, in sight of all the Christian virtues, is deserving of the apostolic declaration. "And now abideth faith, hope, charity, these three, but the greatest of these is charity." 1 Corinthians, xii. 13. When we have taken for our religion only that which relates to belief, and not that which concerns love and conduct, the heart unchecked and unchanged will be the home of selfishness and impurity; and the time will come, either in this world or in the next, when there will issue from the unregenerate heart those virulent evils, which will paralyse every power of good, will bind the hand and foot, and plunge the spirit into the darkest abysses of folly.

With these views of doctrines forming the clothing of the soul, we see at once the importance of those allusions to garments which are so frequently met with in the old as well as the New Testament. When the prophet predicts the advent of the Lord into the world, and thus opening to mankind the glorious doctrines of Christianity, instead of the miserable shreds of Jewish tradition, he says, "Awake; awake; put on thy strength O Zion; put on thy beautiful garments, O Jerusalem, the holy city; for henceforth there shall no more come into thee the uncircumcised and the unclean."—Is. li. 1. Again, in that well-known prophecy which begins, "The Spirit of the Lord is upon me; because the Lord hath anointed me to preach good tidings unto the meek; he hath sent me to bind up the brokenhearted;" the prophet continues to unfold the gracious purpose of Jehovah in the flesh; "To appoint unto them that mourn in Zion, to give unto them beauty for ashes, the oil of joy for mourning, the garment of praise for the spirit of heaviness; that they might be called trees of righteousness, the planting of the Lord, that He might be glorified."—Is. lxi. 3. Here the doctrine of the love of God manifest in the flesh, is manifestly and righteously called "a garment of praise." What could more powerfully induce the soul to clothe itself with praise than the perception that our Saviour is our Heavenly Father, that the High and Lofly One who inhabiteth eternity had for our sakes condescended to appear in the extreme of His vast domains, the skin of the universe as it were, and by assuming and maintaining a connection with the outer universe, he became First and Last in Himself, and from Himself fills, sustains, and succours all.

When the Lord Jesus said, "Thou hast a few names even in Sardis, which have not defiled their garments; and they shall walk with me in white, for they are worthy; He that overcometh the same shall be clothed in white raiment," he is evidently describing the condition of those who have not stained their profession of the Christian doctrine with impurity of life; they have not defiled their garments now, and in eternity their views would be still purer, they should walk with Him in white. Doctrines in harmony with purest truth, are white raiment wherewith we may be clothed.

The New Dispensation of religion which in the fulness of time would be introduced from heaven among men, is represented as coming down "as a bride adorned for her husband." And, by this language, we are assured, no doubt, not only that this church would regard the Lord Jesus Christ, the Divine Lamb, as the only object of her supreme love, her husband, but that her doctrines would be beyond all precedent, beautiful. She

would be adorned for her husband. Such a glorious system would she have of celestial truth,—such disclosures of heavenly order,—such discoveries of the divine laws as existent in the soul; in the regenerate life; in the heavenly world; in the spiritual sense of the Holy Word; in fact, on all subjects of Divine Wisdom, that to the truly devout and thoughtful spirit, she would truly be “adorned as a bride for her husband.”

There is an interesting intimation of the character of true heavenly clothing in Psalm xiv. “The king’s daughter is all glorious within: her clothing is of wrought gold. She shall be brought unto the king in raiment of needlework [verses 13, 14] where the character of true celestial doctrine is declared to be the gold of love, wrought into system,—love wrought out. The king’s daughter, all such as, animated by pure affections for truth derived from the King of kings, are desirous of graces of the heart and mind, which are worth more than the wealth of kingdoms. They become glorious within, and all their views of doctrine are love as it were speaking, and declaring its true nature. With them, God is love, heaven is love, love is the fulfilling of the law, love keeps the commandments, the Word truly understood, is the revelation of love. Their whole doctrine, like the street of the holy city, is of pure gold, formed by the spiritual embroidery of an intellect which spiritually discerns the harmonious relations of everlasting things. The Word supplies the raw material, line upon line, and precept upon precept. The rational powers weave them into a beautiful system, and prepare them to be worn. And when the judgment, under the impulse of a humble determination to live for heaven, adapts these doctrines to its own special states and requirements, the Christian is equipped in the garments of salvation. “He is glorious within, and his clothing is of wrought gold.”

And here, we should strongly guard against one of the most dangerous delusions which has crept into nominal Christianity; the idea that we are saved by the infinite purity of Christ’s righteousness being imparted to us, and not by actual, practical righteousness. It is true, our righteousness is derived from the Lord, “their righteousness is of me, saith the Lord.”—Isa. liv. 17. But no righteousness will be imputed to us, which has not been imparted to us. His spirit will be imputed to us, so far as we receive it, but no farther. God is a God of truth, and never imputes to any one what he does not possess. “He that doeth righteousness, is righteous.”—1 John iii. 7. The merit of divine righteousness in salvation, is as incommunicable as the merit of creation. The robe of the Saviour’s perfections, has a name on it, which no man knows but He Himself. (Rev. xix. 16). And, yet, numbers neglect to acquire the white robe, or the wrought gold, of imparted truth and love, under the vain idea that the personal perfections of our Lord will be imputed to them. Our food is from Him, but if instead of eating that which He now provides, we were to attempt to live by imputing that which he ate in the days of His flesh, we should die of starvation. So, if instead of receiving, and applying to ourselves the living streams of His righteousness by earnest prayer and earnest practice, we expect His merits to be imputed to us, as righteousness, so that although we are really wicked, we shall be accounted good! although really polluted, we shall be accounted clean; we shall be naked and helpless, in the day when he makes up his jewels. No doubt, the Lord lived on earth for our sakes, suffered for our sakes, died for our sakes, rose again for our sakes, made His Humanity righteousness embodied, for our sakes. “For their sakes, I sanctify myself,” he said, “that they may be sanctified by the truth.”—John xvii. 19. All was done for us to enable us to be sanctified, but not to be put down to our account. When our account is made up we shall find the rule to be, “They that have done good shall come forth to the resurrection of life, and they that have done evil to the resurrection of condemnation.” John v. 29. He comes quickly to give to every man as his work shall be (Rev. xxii. 12). Blessed shall we be, if we watch and keep our garments, made white by His truth, and thus are ready to follow our Divine Leader in the realms of peace, adorning, in humble love, those infinite perfections which make his face to shine like the sun, and his raiment white as the light [Matt. xvii. 2]. We are, then, to speak to the Israelites, who are typified by those of our text the spiritual Israelites, who are as our Lord said, Israelites indeed, and

say first that they clothe themselves with genuine doctrines of divine truth, with the garments of salvation, and that they especially make them fringes in the borders of their garments. After we have meditated upon the doctrines of religion, and seen their fitness to our own states of mind and heart, thus clothed ourselves in them; the next part of our duty is to bring them into life. This is a most important point. Many there are, who put on religion as a dress for the head, and even also for the breast, but do not bring it down to the feet. But we are to make a border for our garments, and the border must be a fringe. The distinctive feature of a fringe is, that the material of which it is composed is divided into small portions, firmly united at the upper part, but hanging with separate forms of beauty at the lower. The idea suggested by this is, that religion must be employed in all the small affairs of daily life, as well as on great occasions, the lowest part of our spiritual dress must be a fringe. Our Lord declared the same important truth when he said, "He that is faithful in that which is least, is faithful also in much: and he that is unjust in the least, is unjust also in much."—Luke xvi. 10.

This practical admonition is of the very highest consequence. One of the most serious errors of life is that our religion is only to be brought out on grand occasions, as some think, or on Sundays, as others practically shew, they suppose. The only way in which we make the truths of religion really ours, is to infuse their spirit and tone into all our little acts in our daily conduct. Life is made up of little things. One circumstance follows another, one act comes after another, each one small of itself, but the whole forming the tissue of our entire outward existence. Our whole journey is made step by step. There are no great swoops made. By little and little, we drive out our evils; and by little and little, we introduce the principles of wisdom and goodness into the whole texture of our conduct. By this, we must not be misunderstood to mean, that we are not to subject the whole man to the government of heavenly laws, but only that we are to do it in each circumstance as it comes to hand, and to do it now, not to wait for great occasions. Let the border of your garment be a fringe.

Many, very many, have no objection to the head or the breast being in the church, but the feet they imagine may be quite otherwise engaged. But the true disciple of our Saviour adopts the language of the Psalmist, "Our feet shall stand within thy gates, O Jerusalem."—Ps. cxxii. 2. He is particularly watchful over his feet, or his daily practice. If in his moments of weakness he wavers, he looks up to the Saviour, the Source of strength, and prays, "Hold up my goings in thy paths, that my footsteps slip not."—Ps. xvii. 6. Often will he have to confess, "But as for me, my feet were almost gone; my steps had well nigh slipped."—Ps. lxxlii. 2. Yet will he find invisible hands have borne him up, for his ever-watchful Father has given his angels charge concerning him, lest he dash his feet against a stone.—Ps. xci. 11, 12. And again will he find occasion gratefully to exclaim, "O bless our God, ye people, and make the voice of his praise to be heard: who holdeth our soul in life, and suffereth not our feet to be moved."—Ps. lxxvi. 8, 9. If, like Peter, at first, he thinks it quite beneath his Master's dignity to purify the lower concerns of life, and declares, Thou shalt never wash my feet, when he is better informed, and hears the Saviour's words, "If I wash thee not, thou hast no part in me," he, with an entire spirit of self-devotion, exclaims, "Lord, not my feet only, but also my hands and my head."—John xiii. 9.

This religion of daily life is the grand necessity of the world. Without that, our sabbath worship is but an organized hypocrisy. We should pray, that we may be able to practise, not to substitute prayer for practice. Beautiful as is the devout worship of the sanctuary, sweet as is the devotional piety, and soul-exalting as are hymns of gratitude; they are only the unsubstantial beauty of a dress, unless they are brought down to give direction, purity, and strength to daily life. Let there then be a fringe for the borders of your garment, throughout all your generations.

It is for want of this descent of religion into daily life, that its blessings are often very faintly felt. The sweetness of the knowledge of the Lord is only experienced when religion has become a living hourly series of virtues with us. It is said of the disciples who were going to Emmaus

though the Lord walked with them, and they felt the holy glow of his presence when he talked with them on the way, he only became known to them in "the breaking of the bread." It is so with His disciples in all ages. As long as the "bread of life" is received in a mass, and remains thus, the blessing of conjunction with the Divine Being is unknown. He is with them, but as a stranger. But let them break the bread; let them at home and abroad, in the counting-house and on change, in the workshop and at market, in their pleasures and in all their family duties, break the bread of heaven, and apply it to every work and word, and they will then know the Lord. "Then shall we know, if we follow on to know the Lord: His going forth is prepared as the morning, and He shall come unto us as the rain; as the latter and former rain upon the earth."

O, then let our religion not be like a Sunday dress, put on only for parade on state occasions, and put off when the occasion has passed by, but like a simple daily robe, whose usefulness is seen of all, and whose fringe goes all around the hem of our garment, so that it extends over the whole circle of our outward life.

We are, however, not only commanded to have a fringe to our garments, but to have upon the fringe a ribband of blue. And this leads us to consider the correspondence of colors. Natural colors we know originate in natural light. They are the separation of the beauties which are bound up in the sunbeam, and their reflection to the human eye. There is a trinity of fundamental colors, red, blue, and yellow. From the blending of these in varied proportions all others are made. Blue and yellow form green.

Bearing in mind that the Lord is the Sun of the eternal world, and that essential truth shines as a spiritual light from Him, the three essential colors into which light divides itself, will represent the three essential features of divine truth, in its application to man. There are truths of love, which apply to our affections, truths of faith which apply to thoughts, and truths of life. Red, the colour of fire, is the symbol of the truths of love, the fire of the soul. Blue, the colour of the azure depths of the sky, is symbolic of the deep things of the spirit of God, on which faith delights to gaze. Yellow, is the hue of truth which applies to outward life, and in combination with blue it makes green, which corresponds to truth in the letter of the Word, made simple to the common eye of mankind.

Blue gives a sense of clearness and depth, in which it surpasses all other hues. When we gaze into the blue depths of the sky, far above the changes of the clouds, their tranquil grandeur, arching in peaceful majesty far over the turmoils of the world, strikingly images those depths of heavenly wisdom from which the good man draws strength and peace.

"Though round his breast the rolling clouds are spread,
Eternal sunshines settles on his head."

Blue, then, is the colour which represents the spirit of the Holy Word, the depths of heavenly wisdom.

There is, however, cold blue, as it has more of white in it, and warm blue, as it derives a certain hue from red. There has also been some difficulty in determining the exact shade meant by Techeleth, the Hebrew name for this colour. But from a full consideration of the subject we are satisfied it was the name for blues tinged with red, from violet to purple. And this very strikingly brings out the divine lesson by correspondence. While the blue indicates that in our demeanour or in life we should be correct, in harmony with the spirit of truth, the red hue indicates that all our truth ought to be softened, and warmed by love. "Speak the truth in love," said the apostle, and to remind them of this duty, God commanded the ribband of warm blue to be worn upon the fringe of their garments, by the sons of Israel.

Truth without love is cold, hard, and un pitying, and therefore repulsive. Truth with anger is scalding hot, and like medicine, impossible to be taken, useless or injurious; but truth coming from a loving heart, firm, but gentle, and sweet like the warm sunbeam, is welcome to all.

The loving blue of the eye, which reveals the sweet impulses of a soft

and gentle heart, is like the color of the ribband, before us; it speaks of the purity and the warmth of the spirit within. Let there, then, be upon all your demeanour this color of heavenly love.

Seen in this view we have now arrived at, this commandment increases in practical importance the more we contemplate it. Perhaps the neglect of it is the cause of more failures in the delivery of well-meant advice, than any other circumstance. We proceed to correct with the rough, stern hand of truth alone, and we encounter resistance. We are sure we are right, and we proceed to reproach and invective. Quarrels ensue, instead of amendment. We brood over our failure, and wonder at the perversity of mankind, not reflecting that we have not put on the fringe upon our garment, the ribband of heavenly blue.

"O be kind to each other,
The night's coming on,
When friend and when brother,
Perchance may be gone."

Nothing can be farther from the spirit of heaven, than a stern, harsh, vindictive utterance of truth. We should ever remember that we can ourselves only be assisted by one who manifests to us a spirit of kindness in his counsel. To an assailant we close up. We cannot bear our faults to be exposed by one who does it in a spirit of exultation and insolence. But we love the friendly hand which has a brother's touch. We delight to see the dress not starched with prudery, but having upon all its fringe the ribband of heaven's own blue.

With this blessed tone, how often would homes be happy which are frequently torn with dissension. A brother will be gentle from courtesy to others, but is sulky or sharp to his own. A sister, from politeness, will be brilliant and fascinating to visitors, but often fails to wear the blue ribband to those of her own fireside. Oh, if the Christian ministry has one object which more than another should be its constant aim, it should be to contribute to the happiness of home, that sacred centre of all that is elevating, strengthening, purifying, and ennobling among men. And nothing will be a truer source of all these blessings than to speak to brothers and sisters, and say, in all your intercourse with each other, let the spirit of religion be visible. In each small act of daily intercourse with each other, let there be a fringe from your religion within, and on the fringe let the truth of intelligence be blended with the kindness of real love. You were created to learn to be fellow angels in the house. You were placed to walk together on your path to heaven, to give an assisting hand when a weak one stumbles, to exhort the slothful, to cheer the weary, to warn against danger's path and dangerous foes, to encourage the struggling, to rejoice together when you gain a glorious prospect, to animate each other to your daily progress, and often to taste by anticipation the triumph you will have when all the dangers of life are gone by, and heaven is forever your home. Remember the charge of Joseph to his brethren, "See that ye fall not out by the way." In your acts and your words, let there be seen upon all your fringe, the ribband of heavenly blue.

We come, now, to a still dearer connection, which would often be more blessed if the spirit of this divine command were more faithfully carried out.

In that most sacred of all human ties, the marriage union, it is of the highest importance that the blue ribband should appear in all the demeanor of husband and wife. Yet, sometimes the domestic hearth is less tender and happy than it might be, for want of the gentle amenities of truth spoken in love. When that mysterious sympathy which attracts congenial souls to each other, first induces ardent thought in the young lovers, the earnestness of affection presents to both only what is amiable and agreeable. Each finds a magnifier of the excellencies of the other, and no imperfection can be seen. And, when the hopes of both are crowned by possession, a long vista of happiness is beheld, thronged with an endless succession of joys and blessings. Yet both parties have failings. The perfection fancy has painted, will, in many respects, be found to be overdrawn. The bloom of outward beauty will wear off. Possession will

deprive many attractions of the exaggerated value for which they were chiefly indebted to passion. Both are probably young, both imperfect, both are human. Hence, there come discoveries of faults and shortcomings which belong to us all, but which have been before unseen. And now is the opportunity for the manifestation of real love, in having patience with the loved one. If they have loved wisely, the virtues of each other, and that mutual adaptation of feeling, taste, and character which has drawn their souls to desire a union impossible with any one else, have been the chief attractions; and for their sakes, they can well afford to bear with some defects. Instead of being astonished to find that the mere mortals we have married have some of the failings of our fallen race, we should take kindly the opportunities of showing, that ours has not been the selfish passion which desires only its own gratification, but rather the holy affection that, forgetful of self, seeks chiefly the happiness of those we love. To assist, and be assisted, to form angelic characters in each other, these are the chief objects for which marriage has been instituted. And to accomplish these ends, we must have a faithful, but a friendly eye for the imperfections of each other. We should scarcely notice the unpleasant effect of faults in relation to our personal gratification, but be quicksighted to perceive the injury they inflict upon the doer. "Who is so blind as he that is perfect," says the prophet, in reference to that Divine Mercy which sees not our sins so far as they are directed against Him, and condemns them, only as they are fountains of misery to ourselves.

Our Lord washed His disciples' feet, and said, "As I have washed your feet, so must ye wash one another's feet." And if to assist each other, to remove imperfections from our conduct, which is spiritually washing one another's feet, is a duty we owe to our ordinary Christian friends, how much more is it a duty to assist in removing the spots which soil the characters of those we have undertaken to love and to cherish. Yet what tender care this duty needs. The true wife, or husband, cannot bear to think that the deeply-prized love of the other is being lost. Noticing a fault rudely, betrays the appearance of dislike, and wounds deeply. Sometimes, self-love will creep in between married partners, and the struggle for power will take the appearance of opposition to faults. Then lacerated feelings are poured forth in bitter expressions. Then, quarrels arise, long animosities are inaugurated, which take from home its sweetness, banish all those tender endearments, those happy confidences, those heart-felt reliances on each other, those fireside pleasures which constitute earth's nearest likeness to heaven. Then oppositions are engendered, recriminations are heard, hateful everywhere, but intolerable from those we love. Distrusts, fears, and anxieties intrude, where only confidence should reign, and home becomes the saddest abode of misery. All this has happened, will happen, if we are not careful, in our married life especially, to speak the truth in love. There, above all, the blue ribband should be seen upon our garments. Sweetness in our goodness and tenderness in our truth, should be the incessant law of married partners to each other. A fearfulness of injuring the feelings of the other: A friendly, kindly touch, when any mental sore requires attention: A determination to do nothing, which does not manifest a constant affection: A deference to each other's wishes: A manifest active effort to promote the other's happiness; These are the dispositions which can alone preserve and complete that choicest of all Divine Blessings—genuine conjugal love.

When misunderstanding has been sustained, and bruised affections manifest how deeply they are hurt, their pain should not be treated lightly. He would be thought cruel who trampled on the inflamed foot of another, yet the anguished heart is sometimes tortured with stinging words of bitterest taunt and reproach, under the delusion that it is necessary to blame where fault has been committed. The first necessity is to bring ourselves into a state of real kindness and affection; then ascertain if the supposed fault be as real as it appeared. If so, to ask for Him who views us all from kindness, for wisdom, first pure, then peaceable, to speak the truth in love. While our ribband is blue, to take care that it is soft and warm. How desirable this is in our intercourse with others! In our intercourse with those who are to form with us the happiness of heart and home, it is indispensable.

And yet it is not at all uncommon for unwise married partners so far to neglect this divine commandment as to be all smiles to others, and to reserve their coldness for those whom they should most fondly cherish. The husband open, smiling, and sedulously polite to any other lady, will be reserved, negligent, uncourteous, and unkind to the heart which should be to him above all price. The wife, all-radiant with smiles to others, attentive to their minutest wishes or comforts, will not trouble herself to retain or regain the affections of that one, on whom all her real happiness depends. The gentle, conciliating word, for which her husband's heart, beneath a firm exterior, is longing, she will not speak. The one she won by gentleness, and grace, and all the feminine virtues, she will not preserve by growing in those virtues, but rudely repels. And the heart whose faintest throb she once valued beyond all earthly riches, she rudely throws away.

O married partners, tenants of the same home, who should be all in all to each other, for time and for eternity, never neglect in your sentiments, your spirit, your acts, and your words to each other, to let there be visible on all the manifestations of character with which your life's dress is fringed, the truth and the love of celestial blue. O wife, matron, mother, remember your strength is in tenderness. Never shock the feelings of your husband by harsh, bitter, unwomanly exasperations. Your peculiar province is at home; let it be ever preserved sacred to domestic peace, by a meek and quiet spirit. So you will be your husband's dearest trust, and chief consoler; your children's constant refuge; and when you have passed beyond the shades of time, the star of fond remembrance that shines high above the cares of earth, and lures them still to heaven.

O husband, O father, on whom the wife's fond heart desires to lean, let no harsh expression drive her thence. A yearning of unspeakable tenderness keeps you within her presence, mentally, wherever you may be from morn to dewy eve. And, when you return, she expects the friendly greeting; let her not be disappointed. Be assured her love would encircle you, if you were driven from the common ranks of men; her heart would be the truest pillow for your aching head. Her grace, her happiness, is the worthiest ornament for you now. Your strength is cold, repulsive, and forbidding, until it is combined and chastened by the gentleness and sweetness of your faithful, loving wife. Let her be cheered, then, to see upon the fringe of your garments, the clearness and the warmth of true celestial blue.

It is equally important that the firmness and clearness of truth, blended with the warmth and gentleness of love, should be visible in all our intercourse with our children. Firmness, without gentleness and cheerfulness is painful and repulsive to children, and they shun the circle of its influence as much as possible. Softness, without firmness, strengthens their hankerings for selfish indulgences, and increases those disorderly demands which at length must be restrained with rigor, a hundred-fold more painful, or they must sink in ruin. Children look for just direction, and their sense of justice leads them readily to acquiesce in what is right when it comes from lips they love. Only let the true blue ribbon be seen by your children always, and they will follow where you lead, and your counsel will be laws they will revere in your absence as well as in your presence; and when the music of your loved voice will be heard by them no more, its recollections within will be prized as the tones and the wisdom of those dearest and best-beloved ones who piloted them safely in the early walks of life, and still have only gone before them, and are waiting to welcome them on the purer plains of heaven.

This attention to the very externals of the Christian life is fraught with blessing every way. It is only thus, in fact, we can obtain strength to be healed of our spiritual diseases, and only thus we can exhibit the worth of our principles to others. When the poor woman who had spent her all upon helpless physicians for twelve years came to Jesus, she said within herself: If I touch but the hem of his garment, I shall be made whole, and as soon as she did so, virtue went out, and she was healed.

In the hem of the vesture of Divine Truth, or in other words, in the literal sense of the Word of God, the divine virtue is ever present for the meek and lowly, and when it is touched by trusting love, that virtue will go out.

The prophet Zechariah, speaking of the glorious church of the latter days, the church which is now unfolding itself amongst us, the New Jerusalem, declares, "Thus saith the Lord of hosts: In these days it shall come to pass, that ten men shall take hold out of all languages of all nations, even shall take hold of the skirt of him that is a Jew, saying, 'We will go with you; for we have heard that God is with you.'—viii. 25. It is religion in life that is observed by, and is attractive to, good men. When it not only enlightens the head and rules the heart, but comes down to the skirts of the garment, infusing justice, kindness, and courtesy into every act and every word, then it has an eloquence which will inspire many a well-disposed heart to say: 'We will go with you, for we have heard that God is with you. Let your good works, and your good words so shine before men, that they may glorify your Father which is in heaven.'"

While you pay due and supreme attention to the interior principles of love and faith, never forget the fringe. Let your religion come out. Be loving and truthful in little things. Let your daily duties, and daily expressions unobscured in them the spirit of heaven in their entire round, and thus upon the fringe let there be seen THE RIBBAND OF BLUE.

EXPERIENCE OF A SUN REPORTER IN NEW YORK.

Slightly altered from N. Y. Sun.

A Sun reporter being desirous of finding out something definite regarding the New Church doctrines, proceeded to No. 20, Cooper Institute, New York, and inquiring who was the head man of the denomination, a gentleman [Mr. Thomas Hitchcock] answered:—

There is no head man in our denomination; that is to say, there is no one whose lead we follow without question. We all think for ourselves, although, of course some are more familiar with the writings of Swedenborg than others.

Reporter. Do you understand the doctrines?

Mr. H. I do, I have studied them about twenty-one years.

Reporter. Well, what are you Swedenborgians driving at?

Mr. H. We think we have got the true science of religious truth, and want to teach it to the world.

Reporter. Science of religious truth! Do you mean to say there is any science in religious truth?

Mr. H. We mean to say, and we do say, that religious truth is as capable of scientific arrangement and explanation as any other truth, and that we are able to give this scientific explanation. The New Church theology bears the same relation to all other theologies that the Copernican system of astronomy bears to the Ptolemaic, the Arabic, the Hindoo, and the Chinese systems of astronomy. Those systems of astronomy were based on the mistaken appearance of things, whereas Copernicus and his followers got at the realities. Just so other systems of theology are based on appearances, while the New Church system is based on the real truth.

Reporter. What do you mean by "appearances"?

Mr. H. I mean the way that things appear to the senses. For example, the sun appears to rise and set, and to go daily round the earth. The sky appears to come down to the earth all around, forming what we call the horizon. The earth appears to be stationary in the centre of our universe. The sun appears to be a small orb, not a millionth part as large as the earth; the planets seem no bigger than marbles, and the fixed stars appear to be mere twinkling points. All these appearances are controverted by science, and the senses have to yield to reason. It is the same in spiritual and religious matters, which abound with fallacious and misleading appearances, and these appearances have to be corrected, and in the New Church system of theology are corrected by spiritual science.

Reporter. That all sounds very well, in a general way; but let us get at something specific. What do you say for example to the doctrine of total depravity? I used to know a pious old lady, when I was a boy, who was strong on that doctrine, and who always closed every argument on the

subject by saying, "Well, when you take away my total depravity, you take away all my religion." What do you say to that?

Mr. H. Our doctrine as to that matter is, that all human beings are born with sinful inclinations, (and of themselves are nothing but evil), but need not commit sin unless they choose to do so, and are not accounted guilty of sin unless they actually commit it.

Reporter. Then you hold that all children that die before they reach the age of moral accountability go to heaven, no matter how wicked or Heathenish their parents may be.

Mr. H. We do most emphatically; it is a monstrous error to suppose otherwise.

Reporter. But if no infants whatever go to hell, what becomes of the doctrine of infant damnation?

Mr. H. I'm sure I can't say, unless it goes where it would send the infants, as it certainly should.

Reporter. But if the doctrine of total depravity is not true, what need have we of a Saviour?

Mr. H. To save us from our sinful inclinations, and from actual sin committed by every one personally.

Reporter. How did He, or how does He do that?

Mr. H. It is not easy to tell off-hand how He does it. In order to explain it, it is necessary in the first instance to explain our views of the intimate connection between this world and the spiritual world, including both Heaven and Hell.

Reporter. That is just what I want to get at, please go on?

Mr. H. The spiritual world is not remote from this world, on some unknown planet, as is commonly supposed. It is right here, close to this world, and within it. When a good man lives a good life, he draws angels and good spirits, who inhabit the spiritual world, near him; if he lives an evil life, he draws evil spirits and devils around him.

Reporter. What is the difference between a good spirit and an angel and an evil spirit and a devil?

Mr. H. A good spirit is a good human being who has passed from this world, but who has not yet become an angel. An angel is a good human being who has been perfected in the spiritual world up to the status of angelhood, and been thereby elevated into heaven. An evil spirit is a wicked human being who has passed from this world, but has not yet become a devil. A devil is a wicked human being, who having passed into the world of spirits, has blossomed into full blown devilhood, and gone to his home in hell.

Reporter. You talk about the WORLD OF SPIRITS, as though it were a place to which good and bad spirits go in common, previous to their being sent to heaven or hell.

Mr. H. Yes, the world of spirits is an intermediate state between heaven and hell. It is where all go immediately after death, before we are finally arranged and disposed of according to our real characters. Now to come back to the spirits which a man draws about him in this world by his life, and on which I must predicate my explanation of the work of salvation which the Saviour did for us; By the instrumentality of good spirits and angels, the LORD is always trying to save us from the machinations of evil spirits and devils. But when the human race is unspeakably wicked, as it was at the time of the Lord's appearance on earth, special efforts to this end are necessary. At the time of our Saviour's advent, the evil spirits and devils had got such a hold upon men as to take possession not only of their minds and hearts, but of their bodies also, as we read in the Gospels, and the instrumentality of angels and good spirits was not sufficient to resist them. The LORD, therefore came Himself down to the plane of human life, and on that plane fought with his own Omnipotence against hell, and its allies, drove them back, and thus saved man from destruction.

Reporter. Do you mean that it was God Himself who did this?

Mr. H. Yes, I do. There is but one God. The Son of God is the name given to His manifestation of Himself here on earth, and the Holy Spirit is the holy influence that proceeds from Him.

Reporter. What becomes of the vicarious atonement then?

Mr. H. The vicarious atonement, as expounded by old fashioned theologians, is a misconception of the truth, just as the Ptolemaic system of astronomy was a misconception of astronomical facts. It rests upon the assumption that God was angry with His creatures and needed to be pacified, and would not be reconciled to the offenders until some one had been adequately punished for their offences. God's alleged anger is only an appearance induced by our guilty conscience. The truth is that God loves the sinner just as much as He loves the saint, and always seeks the sinner's good, for "His tender mercies are over all His works," extending even to the lowest hell. The infinite love of our Heavenly Father is such that He "makes His sun to rise on the evil and on the good, and sendeth rain on the just and on the unjust" and "is kind to the unthankful and to the evil." To remove the appearance of anger, it is only necessary for us to repent of our sins and turn to the Lord; just as, to come from night to day, it is necessary for the earth to turn, and not for the sun to change its position. The sun shines on just the same all the time, whether it be hidden by clouds or shut out from us by the earth's turning away from it; and so, too, does the Lord's love shine on just the same all the time, no matter how it may be obscured by the clouds of evil, or shut out from our hearts by our turning away from the Lord. So you see that redemption was a deliverance from the powers of hell, to enable us to turn again to God, and was not a deliverance from the wrath of God, as the phrase is usually understood. The work which the Lord did in redemption was indeed vicarious. He did in our place what we could not do for ourselves, Atonement again, means reconciliation—or, as it is sometimes spelled at-one-ment, and it is we who are reconciled to God, and not God to us. He does not need any reconciling, but we do, because it is we who have gone astray. It is we who must be brought back. To repeat our astronomical illustration, there is no change in God any more than there is in the sun; it is the earth that must turn in order to receive the sun's heat and light. Sin is the great cloud that intercepts the heat and light, or the divine love and wisdom, proceeding from the Sun of Righteousness. "Your iniquities have separated between you and your God, and your sins have hid His face from you."

Reporter. All the preachers say the same thing, that we must turn to the Lord and seek salvation. Is your way of doing that different from theirs?

Mr. H. I will not attempt to state their method, but will only tell you what ours is. Our way of turning to the Lord is to repent of one's sins, pray to the Lord for help, and above all to keep the commandments.

Reporter. That seems to be orthodox. I was brought up a Methodist, and that is just what they preached. There does not seem to be much practical difference, after all, between you and the rest of the religious world.

Mr. H. I should be very glad to believe that that was so. The use of all religion is to make good men and women on earth, and angels in heaven; so far as the Methodist, Catholic, or Mahometan religion can do that, it has my hearty sympathy. Indeed Swedenborg teaches that in the providence of the Lord, believers of all forms of religion are saved if they only lead good lives, according to their religious precepts.

Reporter. What is the advantage of your form of religion then over others?

Mr. H. The advantage consists in being free from the errors and misconceptions which embarrass and mislead believers in other systems.

Reporter. What errors and misconceptions do you refer to?

Mr. H. That of God's being angry with us and demanding a victim to appease his wrath, for example, and the consequent misconception of the real nature of the atonement, the trinity of three distinct persons, the doctrine that heaven and hell are arbitrarily given by the Lord, and are not the result of eternal laws, these and kindred errors following from them, puzzle and confuse people's minds and prevent them from doing as well as they would if they knew the truth.

Reporter. If the Lord does not send a man to hell, who sends him there?

Mr. H. He goes there of his own accord, and because he likes it better than he likes any other place.

Reporter. If you will enable me to comprehend that, and see that it is true, you will contribute much to my peace of mind.

Mr. H. How so? would it contribute to your peace of mind to see that if you should ever become an inmate of one of those loathsome hells of the fourth or sixth ward of New York,—say a negro dance-house,—it would be because you had become so degraded that you would go there, and live there, and make your living by living there, from pure love for such a life?

Reporter. The very idea makes my soul turn sick.

Mr. H. Very well, then how can it contribute to your peace of mind to see and believe that if you go to hell from the world of spirits it will be because you will have become so vile and loathsome in all the attributes of your spiritual nature that you will prefer the society of devils to that of angels, and the wickedness and corruption of hell to the purity and holiness of heaven?

Reporter. On reflection I do not think my peace of mind would be much re-enforced by such a belief. But I want you to explain how people go from the spiritual world to heaven or to hell.

Mr. H. Before I do that, tell me what your idea of heaven is.

Reporter. Heaven is the eternal home of the redeemed, it is the home of never ending rest, it is a place of eternal happiness.

Mr. H. What makes heaven a place of happiness?

Reporter. Why, God makes it so, of course.

Mr. H. But how does he make it so? In what does the happiness of heaven consist?

Reporter. Why, in being happy, I suppose. And the redeemed are made happy by contemplating the glories of their Redeemer; by singing endless praises to Him, by wearing golden crowns and robes of spotless white, and roaming those sweet fields which as the old hymn says, beyond the swelling flood stand dressed in living green.

Mr. H. That is to say, the happiness of heaven, according to your views, consists in what might be termed a never ending religious holiday with nothing to do except to sing praises to God, and feast on what you call heavenly delights?

Reporter. Yes, that is about it.

Mr. H. How would you like that here on earth? How would you like to stand in a temple or a garden for years, wearing a white robe, and with a gold crown on your head, and a gold harp in your hand, and with nothing to do but to sing psalms? Or to put it briefly, how would you like to live in everlasting idleness here if you could.

Reporter. It would be intolerable, of course. It would kill me or drive me crazy.

Mr. H. Exactly, just as it has killed or driven mad many a man who, having amassed wealth, and foolishly imagined that it would be heaven on earth to live in splendor and idleness, has supplied himself with a luxurious home, and quit business to enjoy it. Does not every such man find out his mistake?

Reporter. Yes, I went up to Connecticut last year and interviewed one of these very men. He had an earthly paradise, but the devil was in it in the shape of idleness, and the poor rich old man told me he was going to start an orphan asylum, and run it himself, just to have enough to do to keep him from going crazy or committing suicide.

Mr. H. You have hit it exactly. Activity is a law of life. Idleness leads to stagnation, and stagnation is death. Every man must be active. A good man wants to be all the time doing something useful, an evil man wants to be all the time doing something harmful. The old gentleman that you interviewed in Connecticut, being a good-hearted man, his irrepressible craving for activity burst out in a charitable direction and he founded an orphan asylum. If he had been a bad hearted man his activity would have taken an evil direction. In the spiritual world every one has the same passions and desires as here. The good spirits seek to be useful and the bad spirits seek to gratify their evil dispositions. The same laws govern the coalescence of the inhabitants of the world of spirits into societies or communities which govern the same thing here. In this world the vicious seek out and consort with the vicious and the good consort with

the good. Take the people who arrive in this city, for example, on any given Saturday night and Sabbath morning from all parts of the country. They are here relieved from the conventional restraint which keeps them in order at home, and every one is free to gratify his appetites at his will. You understand such things, and very well know that many of those persons who, if at home on that Sabbath would go to church, and exhibit a deal of hypocritical piety, will go to the haunts of vice in this city, and scoff at all religion, and wallow in wickedness. Every one of them who loves the company of the vicious, will seek out vicious companions, and go where he will enjoy himself most. On the other hand, those who really love the Lord, and in their very hearts want to do the right thing wherever they are, will seek out some church on that Sabbath, or will in some way show out and act out the love for the Lord and his people which dominates their lives. So, when people arrive in the spiritual world where all conventional restraints are removed, every one acts out his real nature. The wicked gradually sort themselves out from the good, and gravitate by choice to the hells. A hell is simply a society in which wickedness holds entire sway, and the worse the wickedness the worse the hell.

Reporter. But how about the punishment for sin? Is not hell a place of torment? and if it is, why do even the wicked like to go there?

Mr. H. Why do the wicked go from choice into the hells of this world, and voluntarily accept the loss, disgrace, ruin, disease, suffering, and death, which come of going there? People are the same in the world of spirits that they are here; that is to say, they are human beings. Suppose you and I were to be struck dead this moment, and pass into the spiritual world. You would be you, wouldn't you, and I would be I? We should have the same spiritual natures which we have now, you would like there what you like here; and it would be the same with me. If we really love God and our neighbour here and now, we should love God and our neighbour there and then. If we love what is pure and holy here we should love what is pure and holy there. But if we really in our hearts love self, and the world, and evil and wickedness here, we should love the same there, no matter what we may pretend to love here. And loving wickedness we should go among the wicked, because we should prefer to do so. And being among the wicked, we should, of course, have a wicked and unhappy time of it, and grow worse and worse, and become very devils, and be tormented by our own burning passions and by our fellow devils, and suffer unspeakable anguish; and yet we would prefer that devilish state to heaven, just as the human devils in this world prefer their horrible life surroundings to the society of good Christians.

Reporter. I understand how it must naturally be as you say; but still I do not see where the punishment which God inflicts on sinners for the sins they committed in this world comes in.

Mr. H. The Lord does not punish people hereafter for deeds done in the body. "Sufficient unto the day is the evil thereof." In the Lord's dealings with His creatures there is no such thing as punishment, in the sense in which that word is generally used, but only philosophical consequences. If you take hold of hot iron, it burns you. The burning is not a punishment, arbitrarily inflicted, but only a natural consequence. If a man eats or drinks any thing poisonous or hurtful, the inevitable consequences follow, and his body is injured, or perhaps his life sacrificed. So, too, if a man commits sin, his soul is injured, as a spiritual consequence; and by continuing in sin, he comes to love it, and his soul gets such an appetite for it that he continues sinning in the world of spirits, and grows in wickedness, and finally goes to hell, as a spiritual consequence of his sins, just as a drunkard finally goes to a drunkard's grave not as a punishment arbitrarily imposed upon him for his offence, but as a physiological consequence of his excessive indulgence in strong drink.

Reporter. Do men go to heaven on the same principles?

Mr. H. Precisely. By cultivating during this life love to the Lord and to the neighbour, a good man, with the Lord's help, acquires the habit of enjoying the exercise of his good affections and in the other life seeks the society of companions of a like character. It is easily seen that a community of people all loving and obeying the Lord, and all loving one another and trying to do the greatest possible good to one another, must make a heaven wherever they may be.

Reporter. What chance is there for doing good to your neighbours in heaven? Doesn't the LORD give your neighbours all they want there without your help?

Mr. H. He does not do it there any more than he does it here, you must remember that our happiness comes through the right use of the faculties which the LORD has bestowed on us. The LORD works by instrumentalities in heaven the same as he does here. For example, he gives us the relation between husband and wife, of parent and child, of teacher and scholar, to bring into activity and to gratify our deepest and tenderest affections, and it is only in this way—that is, by the exercise of our affections;—that we can get any development.

Reporter. Do you mean to say that there are the relations of husbands and wives, parents and children, and teachers and scholars in heaven?

Mr. H. I do. Natural death has no power to effect a permanent separation between a husband and wife who have tenderly loved each other in the world and at the same time were grounded in sincere love to God. There are husbands and wives in heaven as there are on this earth; and though no children are born there yet the children who die in this world, and who all go to heaven have to be brought up and educated to adult age; so, too the ignorant good people among Christians and the good among the heathen, who all go to heaven, have to be instructed there. And in fact what do the wisest of us know in comparison with the angels who have been in heaven for thousands of years? As arrivals there are incessant, there is never any cessation of the work of instruction.

Once there is the exercise of the parental office, and the relation of teacher and scholar. Did it ever occur to you to imagine what has become of the myriads of infants that have died and gone into the world of spirits. Do you suppose that infants that died five thousand years ago are kept bottled up somewhere as infants still? Are all the infants that have died, and that are dying, and that will hereafter die, to be kept for ages upon ages in an infantine state, and then be finally judged as infants, and sent to their doom as infants, and kept as infants,—myriads of them not one hour old—throughout eternity? Do you suppose there is to be any such waste of immortal material as that? Is it not more reasonable to suppose that the LORD in the exercise of His infinite love and wisdom, has made provision for their care, and comfort, and instruction? It would be justly considered an act of atrocious cruelty to send countless infants off to some distant land, without making any provision for their welfare when they should arrive at their destination. And is there any reasonable religious being on earth who would dare to imagine that the LORD has not made ample provision for the welfare of all His little ones that go in their helplessness to the unseen land?

Reporter. All the mothers will be apt to accept your doctrine as to the fate of infants in the other life. It looks reasonable. But if Swedenborg's views are correct, it strikes me that a great many good Christians are foredoomed to disappointment, and will not find the heaven they longed for.

Mr. H. There you are mistaken. Swedenborg expressly says, that every good person, on his first arrival in the world of spirits, finds exactly the heaven he believes in.

Reporter. Why is that?

Mr. H. To take the nonsense out of him. When people imagine that heavenly happiness consists in endless worship, or singing, or sitting on beds of flowers, or roaming in paradisaical gardens, or feasting with the patriarchs, or merely getting into a place called heaven, they are allowed to try the experiment, till they become so disgusted that they wish to break away from such enjoyments, and escape to some place where they can find something useful to do. They are then instructed that heaven consists in performing uses—doing useful things—in the name of the LORD, and right glad are they to learn that lesson. The essence of heavenly delight is the doing of good to others, and not the selfish gratification of one's own desires. Swedenborg says that the angels not only love the neighbour as themselves, but better than themselves, and find ineffable delight in ministering to their neighbours. That is in accordance with the teaching of the LORD while on earth: "But he that is greatest among you shall be your servant." (Matt. xxiii. 11.

Reporter. But what do angels find to do in heaven?

Mr. H. Every thing that good men and women do in a perfect state of society on earth, with of course such exceptions as grow out of the difference between the material and the spiritual worlds. Some are teachers of religious truth to new comers from this world. Some, particularly women, take care of infants and children. Immense numbers are engaged in watching over us who still live here in this world. "Are they not all ministering spirits sent forth to minister for them who shall be heirs of salvation," (Heb. i. 14), and as many, if not more, in ameliorating the miseries of the inmates of hell. It is there as it would be here in a community of good and benevolent people, each one does what he is best qualified for to promote the general welfare and happiness.

Reporter. Will people know each other there?

Mr. H. Yes, but if that knowledge is only of the outward seeming as it often is in this world, and not of real interior character, it will soon pass away, because there everybody at length has to show his real character, no hypocrisy is possible there. Hence, unless people have an interior affinity for one another, they do not remain together in the spiritual world.

Reporter. Do you administer the usual ordinances?

Mr. H. We administer the rite of Baptism, and the sacrament of the Holy Supper, and carry on our worship very much like other Christians. We are liberal in our notions as to other sects, and wish them all God speed. The fact is the New Jerusalem is coming down out of heaven in all parts of the world and in all denominations. It has transformed the theology and the preaching of Christendom within a century. Henry Ward Beecher preaches more of the essence of the new church doctrines than some of our own ministers. Bishop Clark of Rhode Island does the same. By the essence of our doctrines, I mean love to God and the neighbour carried out in actual life by keeping the commandments, both in their letter and their spirit.

To the foregoing, we add the following extracts from Swedenborg.

THE CRITERION FOR CHARACTER.—"Man may know which he is amongst, whether amongst the infernal spirits or the angelic. If he intends evil to his neighbor, thinking nothing but evil concerning him, and actually doing evil when in his power, and finding delight in it, he is amongst the infernals, and becomes himself also an infernal in the other life; but if he intends good to his neighbor, and thinks nothing but good concerning him, and actually does good when in his power, he is amongst the angelic, and becomes himself an angel in the other life." "Let a man search out the end which he regards in preference to all the rest, and in respect to which subordinate ends are as nothing; and if he regards self and the world as ends, be it known to him that his life is an infernal one; but if he regards as ends the good of his neighbor, the general good, the Lord's Kingdom, and especially the Lord Himself, be it known to him that his life is a heavenly one." "A man serious in his duty towards God and his neighbor, may always know whether he is on the right road to salvation or not, by examining himself and his own thoughts by the Ten Commandments; as, for instance, whether he loves and fears God; whether he is happy in seeing the welfare of others, and does not envy them; whether on having received a great injury from others, which may have excited him to anger and to meditate revenge, he afterwards changes his sentiments, because God has said that vengeance belongs to him, and so on; then he may rest assured, that he is on the way to heaven, but when he discovers himself to be actuated by contrary sentiments, on the road to hell."

CONCERNING AGE IN HEAVEN.—Those who are in heaven are continually advancing to the spring of life, and the more thousands of years they live to a spring so much the more delightful and happy, and this to eternity, with increments according to the progresses and degrees of love, charity, and of faith. Of the female sex, those who have died old and worn out with age, and have lived in charity towards their neighbor, and in happy conjugal love with a husband, after a succession of years come more and more into the flower of youth and adolescence, and into a beauty which exceeds every idea of beauty ever perceivable by the sight. Good-

ness and charity is what forms and makes a resemblance of itself, and causes the delightful and beautiful of charity to shine forth from the minutest parts of the face, so that they themselves are forms of charity. They have been seen by some, and have excited astonishment. The form of charity, which is seen to the life in heaven, is such, that charity itself is what effigies and is effigied, and this in such a manner, that the whole angel, especially the face, is as it were charity, which manifestly both appears, and is perceived, which form, when it is beheld, is ineffable beauty, affecting with charity the very inmost of the mind. In a word, to grow old in heaven is to grow young; those who have lived in love to the Lord and in charity towards their neighbor, become such forms, or such beauties, in the other life. *Heaven and Hell*. 414.

STATE OF THE WORLD AND CHURCH, AFTER, AND IN CONSEQUENCE OF, THE LAST JUDGMENT.—“The state of the world hereafter will be quite similar to what it has been heretofore, for the great change, which has been effected in the spiritual world, does not induce any change in the natural world as regards the outward form; so that the affairs of states, peace, treaties and wars, with all other things which belong to the societies of men, in general and in particular, will exist in the future, just as they existed in the past. The Lord's saying that in the last times there will be wars, and that nation will rise up against nation, and kingdom against kingdom, and that there will be famines, pestilences and earthquakes in divers places,” Matt. xxiv. 6, 7, does not signify that such things will exist in the natural world, but that things correspondent with them will exist in the spiritual world, for the Word in its prophecies does not treat of the kingdoms, or of the nations upon earth, or consequently of their wars, or of famines, pestilences, and earthquakes in nature, but of such things as correspond to them in the spiritual world, what these things are, is explained in the *ARCANA CELESTIA*. But as for the STATE OF THE CHURCH, this it is which will be dissimilar hereafter; *it will be similar indeed in the outward form, but dissimilar in the inward*. To outward appearance divided churches will exist as heretofore, their doctrines will be taught as heretofore; and the same religions as now will exist amongst the Gentiles. But henceforward the man of the church will be in a more free state of thinking on matters of faith, that is, on spiritual things which relate to heaven, because spiritual liberty has been restored to him. For all things in the heavens and in the hells are now reduced into order, and all things which entertains or opposes divine things in flows from thence—, from the heavens, all which is in harmony with divine things, and from the hells, all which is opposed to them. But man does not observe this change of state in himself, because he does not reflect upon it, and because he knows nothing of spiritual liberty, or of influx; nevertheless it is perceived in heaven, and also by man himself when he dies. Since spiritual liberty has been restored to man, the spiritual sense of the Word is now unveiled, and interior Divine Truths are revealed by means of it; for man in his former state would not have received them, and he who would have understood them would have profaned them.” “Hence it is that after the last judgment, and not sooner, revelations were made for the New Church. For since communication has been restored by the last Judgment, man is able to be enlightened and reformed, that is, to understand the Divine Truth of the Word, to receive it when understood, and to retain it when received, for the interposing obstacles are removed; and therefore John, after the former heaven and the former earth passed away, said that he saw a new heaven and a new earth, and then, the holy city new Jerusalem coming down from God out of heaven prepared as a bride adorned for her husband; and heard one sitting upon the throne say, Behold I make all things new.” Rev. xxi. 1, 2, 5.

The above was written by Swedenborg in 1758, or 115 years ago. The last judgment foretold in Matt. xxiv, Luke xxi. 9, 27, Rev. vi. 12, 17, xvi. 18, and other places, was fully accomplished in the spiritual world, (as described by him), by the end of the year 1757, or the year previous to the one first mentioned, and I appeal to every enlightened mind if the above statements regarding the condition of the world, and the state of the man of church have not been verified by actual historical facts, which even at this day, 1873, have assumed an amplitude which

It would require a volume to describe. The last judgment was executed on such of the wicked as had passed into the spiritual world from the LORD's time until the year 1757, but not upon those who lived previous, for a last judgment had twice before existed on the earth, the first was executed upon the posterity of the Most Ancient church, and is described in the Word by the flood; the other was effected by the LORD Himself when he was in the world, as it is written, "Now is the judgment of this world, now is the prince of this world cast out," John xii. 31. It is of Divine order that a judgment takes place at the end of a church, when ignorance of God, the falsification of His Word, and consequently dreadful wickedness has arisen to such a height that, for the sake of the good, judgment can no longer be restrained. With these facts before us, we can now perceive the infernal origin of that malignant spirit which held supreme sway during the dark ages down to the date in question, and vented itself in murdering, burning, racking, and persecuting millions of innocent human beings in the name of religion. To this period may be assigned the sublime descriptive imagery of the prophet, when he says, "Behold, darkness shall cover the earth, and gross darkness the people," of which we will only say that we have had the darkness with a most terrible verity, for even now the man of the church is but slowly emerging out of it. True order requires that man must divest himself of error and falsities before he can receive truths, and all experience shows that this can only be effected gradually, and little by little, as the understanding becomes enlightened, for the will principle must be convinced from, or by, the understanding, and this in perfect freedom. It can never be forced.

By the holy city New Jerusalem, which was seen coming down from God out of heaven, mentioned in Rev. xxi., and described in the internal sense of the Word, in Isa. lii. 1, 2, 6, 9, lx. 1, 22, lxii., 1, 12, lxv. 17, 22, lxvi., 22, Dan vii., 13, 14, is not meant a city, for it is described as being of pure gold, as being square, twelve thousand furlongs, or about 1500 English miles, each way, and the *height* the same, such a city could not exist on the earth, and is not to be so understood. By a city in the Word, is signified the Church as to doctrine, as when we pray for the peace of Jerusalem, we mean the Church, signified by Jerusalem, and not the city of that name in Palestine, so by the new Jerusalem, and its description by correspondences and symbols, in Rev. xxi., we are not to understand any city, but the nature and quality of a church, or New Dispensation of Divine Truth, drawn from the Word, which would be unfolded to the world after the last judgment had taken place. Every particular of this description involves a spiritual sense which precludes any error from entering into the interpretation. For instance, it is written, "And the twelve gates were twelve pearls; every several gate was of one pearl," v. 21, by which is signified the great and glorious truth that the acknowledgment and knowledge of the LORD conjoins into one all the knowledges of truth and good derived from the Word. That the LORD is the very gate by which to enter the Church and heaven, He Himself teaches when He says, "I am the door; by me if any man enter in, he shall be saved," John x. 9. This is also meant where it is written, "Open ye the gates, that the righteous nation which keepeth the truth may enter in," Isa. xxvi., 2. The LORD further says, "The kingdom of heaven is like unto a merchant man, seeking goodly pearls; who, when he had found ONE PEARL OF GREAT PRICE, went and sold all that he had, and bought it," Matt. xiii., 45, 46. The one pearl of great price, signifies the knowledge and acknowledgment of the LORD; to sell all that he had and buy it, signifies for man to divest himself of error and falsity, and receive this great truth. A rock, stones, precious stones, and pearls, are used in the Word as corresponding symbols of truth, hence the LORD as to the principle of His Divine Truth, is called the Rock, Deut., xxxii. Ps. xcv., 1., and many other places, the "stone of Israel" Gen. xlix., 24. "a stone, a tried stone, a precious corner stone, a sure foundation," Isa. xxviii., 16. The king of Tyre in Ezekiel, represents the man of the Church as to knowledges, hence it is written of him, "Thou has been in Eden, the garden of God; every precious stone was thy covering, the sardius, topaz, and the diamond, the beryl, the onyx, and the jasper, the sapphire, the emerald, and the car-

buncle, and gold" xxviii., 13. It is plain that these expressions are not to be literally understood, but are thus expressed for the sake of the spiritual sense, in which precious stones signify truths. The like is meant by "Eden, the garden of God" in which the king of Tyre is said to have been, which is used in the Word to denote intelligence, and wisdom thence derived. The garden of Eden was as much unknown in the time of the king of Tyre as it is at this day, such a locality as that described in Gen. ii., 8, 14, having no geographical existence on the globe; hence the vain researches, travels, expeditions, writings, &c., of the curious and the learned, during the past and present ages, regarding this subject, they being ignorant that the whole account is to be understood as a pure allegory, descriptive of the state of the men of the Most Ancient Church. This was the universal style of writing among these people, it was derived from a heavenly origin, and they delighted in framing descriptions of this kind, expressing spiritual truths by means of allegories or correspondences, making use of natural objects to symbolize spiritual truths. It must be visible to every one, that when the trees of the garden are described natural trees are not to be understood, for life, and the knowledge of good and evil, do not grow on such trees, and so on with other things. This style of writing is continued to about the end of the eleventh chapter of Genesis, where literal or true history begins, but still of such a nature that it involves a spiritual sense throughout. As mankind receded from a heavenly state, and became corporeal and sensual, believing in nothing which they could not investigate with their bodily senses, the knowledge of correspondences became gradually lost, and remained so, until under the Divine Providence of the Lord it has been again restored to the Church, and made available to unfold the true meaning of the Word. So now those who have hitherto "walked in darkness" may "see a great light," and the Church may be addressed in the sublime language of the prophet, "ARISE, SHINE; FOR THY LIGHT IS COME, AND THE GLORY OF THE LORD IS RISEN UPON THEE."

SUMMARY STATEMENT OF THE DOCTRINES OF THE NEW CHURCH.

I. God is One in Essence and in Person, in whom there is a distinct and essential Trinity, called in the Word the Father, Son, and Holy Spirit, and the Lord Jesus Christ is this God, and the only true object of worship.

II.—In order to be saved, man must believe on the Lord, and strive to obey his commandments, looking to Him alone for strength and assistance, and acknowledging that all life and salvation are from Him.

III.—The Sacred Scriptures, or the Divine Word, is not only the Revelation of the Lord's will and the history of his dealings with men, but also contains the infinite treasures of his wisdom expressed in symbolical or correspondential language, and therefore in addition to the sense of the letter, there is in the Word an inner or spiritual sense, which can be interpreted only by the law of correspondence between things natural and things spiritual.

IV.—Now is the time of the Second Coming of the Lord, foretold in Matt. xxiv., and the establishment of the New Church signified by the New Jerusalem in Revelation xxi., and this Second Coming is not a visible appearance on earth, but a new disclosure of Divine Truth and the promulgation of true Christian Doctrine, effected by means of the Lord's servant, Emanuel Swedenborg, who was specially instructed in this Doctrine, and commissioned to publish it to the world.

V.—Man's life in the material body is but the preparation for eternal life, and when the body dies man immediately rises into the spiritual world, and, after preparation in an intermediate state, dwells for ever in Heaven or Hell, according to the character acquired during his earthly life.

VI.—The Spiritual World, the eternal home of men after death, is not remote from this world, but is in direct conjunction with it, and we are, though unconsciously, always in immediate communion with angels and spirits.

THE FIRST ESSENTIAL KNOWLEDGE.—"The first thing will be to know who is the God of Heaven, since all other things depend on that. In the universal heaven no other is acknowledged for the God of heaven than the LORD alone. They say there as He himself taught, "that He is one with the Father, that the Father is in Him and He is in the Father; and he that seeth Him seeth the Father; and that every thing holy proceedeth from Him." John x, 30, 38; xlv. 10, 11. xvi. 13-16—"The very essential principle of the church is the acknowledgement of the union of the Divine itself in the Human of the LORD and this must be in all and singular the things of worship. The reason why this is an essential of the church, and hence an essential of worship, is, because the salvation of the human race depends solely on that union."

If the doctrines embraced in these weighty sentences were held and accepted by the present church it would assuredly solve the most perplexing theological problem of the age. Thousands of good men are utterly in the dark as regards this grand fundamental truth. Among them we would rank the Rev. W. H. H. Murray, the celebrated preacher of Park St. Church, Boston, who, in the hearing of the writer, during his Sabbath afternoon lecture, April 5, 1874, made statements to the effect that "the doctrine of the Trinity as held by us Trinitarians is an inexplicable mystery; for my own part I never could explain how three distinct persons could be one God, I do not understand it, do not wish to understand it, never could and never will understand it, not even in eternity." A very different estimate may be seen in Jer. ix. 23, 24. "Thus saith the LORD, Let not the wise man glory in his wisdom, neither let the mighty man glory in his might, let not the rich man glory in his riches, but let him that glorieth, glory in this, that he understandeth and knoweth me, that I am the LORD which exercise lovingkindness, judgment, and righteousness in the earth." The time is coming when the earth shall be full, not of the mysteries, contradictions and perplexities of a trinity of three separate persons in one God, for it is full of that already, but when it shall be full of the knowledge of the LORD as the waters cover the sea. It is because spiritual truths, adequate to satisfy the most exalted cravings of the human mind, have been revealed in great abundance at this day by the LORD through Swedenborg, that this humble effort is made to direct attention to his writings. When we know these truths, happy shall we be if we live up to them. "Then shall we know, if we follow on to know the LORD; His going forth is prepared as the morning, and he shall come to us as the rain, as the former and latter rain upon the earth."

MAN SHOULD ACT AS OF HIMSELF.—"Such is the Law of order that man ought to do good as of himself, and therefore not to hang down his hands, under the idea that, because he cannot of himself do any thing that is good, he ought to wait for immediate influx from above, and so remain in a passive state; for this is contrary to order; but he ought to do good as of himself; and when he reflects upon the good which he does, or has done, he should think, acknowledge and believe, that it was the LORD with him who wrought it. When a person hangs down his hands under the above mentioned idea, he is not a subject on which the LORD can operate, since the LORD cannot operate by influx on any one who deprives himself of every thing into which the requisite power can be infused."

ON INFANTS IN HEAVEN.—"It is the belief of some, that only the infants who are born within the church come into heaven, but not those who are born out of the church; because, they say, the infants within the church are baptised, and by baptism initiated into the faith of the church; but they do not know, that no one has heaven or faith by baptism; for baptism is only for a sign and memorial that man is to be regenerated, and that he can be regenerated who is born within the church, since there is the Word where are the Divine truths by which regeneration is effected, and there the LORD is known from whom regeneration is. Let them know therefore, that every infant, wheresoever he is born, whether within the church or out of it, whether of pious parents or of impious, when he dies is received by the LORD, and is educated in Heaven, and according to Divine order is taught and imbued with the knowledge of truth; and afterwards as he is perfected in intelligence and wisdom, he is introduced into heaven and becomes an angel. Every one who thinks from reason knows that no one is born for hell, but all for heaven, and that man himself is in fault that he comes into hell, but that infants can as yet be in no fault."

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Such is Swedenborg's testimony from things heard and seen. It will do any one good to read the entire chapter "On Infants and little Children in Heaven" in his work on "Heaven and Hell" from which the above extract is taken. Now examine the SAVIOUR'S testimony; "Suffer little children to come unto me, and forbid them not, for of such is the kingdom of heaven," Matt. xix. 14. Again, "For I say unto you that in heaven their angels do always behold the face of my Father which is in heaven," Matt. xviii. 10. By way of contrast we shall now present some extracts from eminent exponents of the old theology and let the reader judge which is true and which is false, which is from above, and which from beneath. Augustine's opinion is as follows. "It may therefore be truly said, that infants dying without baptism, will be in a state of damnation of all the most mild. But, greatly does he deceive and is he deceived, who affirms that they will not be damned." *De Peccat merit et Remiss* Lib. 1. c. 16. Fulgentius writes as follows: "We most firmly hold, and by no means doubt, that INFANTS, whether they begin to live in their mother's womb, and then die, or, after being born pass from this life without the sacrament of holy baptism WILL BE PUNISHED WITH THE EVERLASTING PUNISHMENT OF ETERNAL FIRE." *Fulgentius de Fide ad Pet. Diac.* Cap. xxvii.

Calvin, in his reply to Castalio says, "Persons innumerable are taken out of life while yet infants,—and GOD PRECIPITATES INTO ETERNAL DEATH HARMLESS INFANTS TORN FROM THEIR MOTHERS' BREASTS." In his *Institutes* the stern Genevan further inquiries, "I ask you again, how has it happened that the fall of Adam has involved so many nations with their infant children in eternal death without remedy, but because it so seemed good in the sight of GOD?—It is a dreadful decree, I confess." *Inst. Lib.* iii. c. 26.

Zanchius, another high authority of the age of Calvin, in his reply to Pighius writes as follows: "even young serpents and the whelps of wolves, who cannot as yet harm anybody, are put to death, and with justice.—Therefore, EVEN INFANTS ARE DESERVEDLY DAMNED, on account of the nature they have, to wit, a wicked nature and repugnant to the law of God." Even the tender hearted Dr. Watts writes in this way, "Upon the whole, the opinion of the salvation of all children, as it has no countenance from the Bible, so it has no foundation in the reason of things."—"The Scripture brings down the infants of wicked persons to the grave, and leaves them there, and so do I. The Scripture has not provided any resurrection for them, neither can I do it." *Ruin and Recovery, Quest.* 16.

Archbishop Usher, in answer to the question "How doth GOD deal with Reprobates dying infants," says, "Being once conceived they are in a state of death by reason of the sin of Adam imputed, and of original corruption cleaving to their nature, wherein also dying they perish." *Usher's Body of Divinity*, p. 65.

At the Council of Dort the Genevan Professors said, "Of the infants of believers only, who die of an age before they can be indoctrinated, we determine that they are saved," and the deputies from Switzerland expressed their judgment thus, "That there is election and reprobation of infants, as well as of adults, we cannot deny against God, who tenderly loves, and inculpably hates them before they are born."

The Rev. William Twiss, D.D., Prolocutor or Chairman of the Westminster Assembly, writes, "Every man that is damned is damned for original as well as actual sins, and many thousand infants only for original." Again, "If many thousands, even all the infants of Turks and Saracens dying in original sin, are tormented by GOD in hell fire, is he to be accounted the Father of cruelties for this?" *The Riches of God's Love consistent with his Absolute Hatred of the Vessels of Wrath.* Fol. ed. 1653.

Antony Burgess, another member of this famous Assembly, writes, "It is a quickening meditation which Vedelius useth, to make a godly man thankful for GOD'S grace,—ah, how many little children are and shall be in hell, who never had the knowledge of good and evil." *Burgess on Original Sin*, pp. 550, 551. Ed. 1659.

Dr. Manton, a popular preacher at Parliament, who wrote a hundred and thirty-nine sermons on the cxix Psalm, compares "infants to serpents before they be grown," and reasons in favour of this infamous doctrine. *Manton's Sermons*. Vol. 3, Ser. xxv.

We quote from Arthur Hildersham's Lectures on the fifty-first Psalm,

"Against these *damnable errors*, (one of which is that all who die in their infancy shall certainly go to heaven,) you have heard it evidently proved, 1. That all infants are sinners, and deserve damnation. 2. That many infants have been vessels of wrath, and FIREBRANDS OF HELL."

That these assertions are rank with the sulphurous emanations of the pit, we think few will question, but thanks to the advancing light of the New Dispensation, this atrocious doctrine, along with many others pertaining to the old Theology, are fast taking their place among the discarded rubbish of the past. He would be a bold man indeed who would dare to address a congregation in this style at the present day.

ON SPIRITUAL INFLUX—ONLY ONE LIFE.—"From very much experience I am instructed, that there is but one single life, which is that of the LORD which flows in and causes man to live. For there is only one life, namely, the LORD's, which flows in into all, but is variously received, and this according to the quality which man by his life has induced upon his soul; hence with the evil, goods and truths are turned into evils and falses, but with the good they are received, goods as goods, and truths as truths. This will admit of comparison with the light which flows in from the sun into objects, and which is then diversely modified and variegated according to the form of the parts, and is thence turned into colors either sad or cheerful. The heat which hatches eggs wherein lies hid an owl, a toad, or an asp, does the like as when it hatches eggs in which lies hid a dove, a beautiful bird or a swan. The case in general with influx out of the spiritual world into man is this, that man cannot think anything, or will anything from himself, but that everything flows in, good and truth from the LORD through heaven, thus through the angels who are with man; evil and the false from hell, thus through the evil spirits who are with man; and thus into man's thought and will.

He who does not know how the case is with man's intellectual faculty, and how man can take a view of things, perceive them, think analytically, form conclusions thence, and at length refer to the will, and by the will into act, such a one sees nothing to admire herein; he supposes that all things thus flow naturally, not being at all aware that all and single things are from influx through heaven from the LORD, and that man without such influx cannot think at all, and that on the cessation of influx the all of thought ceases."

We may learn from the foregoing the inmost origin of all the ideas, thoughts and various shades of feeling that can possibly enter the mind of man, and the source of that wisdom which he too often fondly calls his own, enabling him not only to think reverently or otherwise regarding GOD and the realities of eternity, but to enter into worldly avocations, such as the planning and building of houses, palaces or ships, inventing and constructing machinery, prosecuting agricultural, professional, or mechanical operations, or in fact everything without exception connected with civilized or uncivilized life. From the spiritual world, the world of causes, flow in those thoughts which we say, "strike the mind" on important or unimportant occasions as the case may be. The origin of these thoughts is all the same whether or not they may be induced by the assistance of external objects; for instance the swaying of a suspended lamp in a vaulted Cathedral was instrumental in conveying an idea of the principle of the pendulum to the mind of Huygens; the fall of an apple led the mind of Newton to investigate the theory of gravitation; the rattling lid of a boiling tea-kettle led Watt to form an idea of the power of steam which resulted in giving us the steam engine; lastly, to adduce another instance, a miner near Newcastle is severely crushed in both his limbs and is consequently confined to his bed for several weeks. He falls into a train of thought regarding the best method of transporting the coal wagons over the tramways from the mouth of the pit to the shipping, without the aid of horses. After long reflection he sends to the field for *two turnips*, and after spending some time in carving them into many curiously shaped pieces, he adjusts each piece exactly into its proper place, and after sending for Mr. George Stephenson the superintendent of the mine, presented him with the first model of a locomotive engine, complete in all its essential parts. Such was the origin under Providence of an invention which has done so much for the world. In every such case it *appears* to man as if his intelligence was self-derived, when nevertheless, the truth as presented by Swedenborg, shows us that his wisdom is derived solely from the infinite source of all wisdom, the LORD alone.

THE EARTH AND THE HUMAN RACE WILL ABIDE FOR EVER.—“That the procreations of the human race will continue to eternity, is plain from many considerations, and of which the following are the principal :—I. That the human race is the basis on which heaven is founded. II. That the human race is the seminary of heaven. III. That the extension of heaven, which is for angels, is so immense that it cannot be filled to Eternity. IV. That they are but few respectively, of whom heaven at present is formed. V. That the perfection of heaven increases according to plurality. VI. And that every Divine work has respect to Infinity and Eternity. The angelic heaven is the end for which all things in the universe were created, for it is the end on account of which mankind exists, and mankind is the end regarded in the creation of the visible heaven, and the earths included in it; wherefore that Divine work, namely, the angelic heaven, primarily has respect to Infinity and Eternity and therefore to its multiplication without end, for the Divine Himself dwells within it. Hence also it is clear, that the human race will never cease, for were it to cease, the Divine work would be limited to a certain number, and thus its respectiveness to Infinity would perish. The LORD did not create the universe for his own sake, but for the sake of those with whom He will be in Heaven; for spiritual love is such, that it wishes to give its own to another; and as far as it can do this it is in its being, in its peace, and in its blessedness: spiritual love derives this from the Divine Love of the LORD, which is infinitely such; from hence it follows that the Divine Love, and hence the Divine Providence, has for its end a heaven, which may consist of men made angels, to whom He can give all the blessed and happy things which are of love and wisdom, and give them from Himself in them.”

Many unstable minds have raised a hue and cry about the world coming to an end, causing much fear and alarm when there was no just reason for it. The earth meant in the Word has come to an end many times, but not so GOD's fair and beautiful world of nature. That is perfect for all the purposes of its creation and will remain so for ever. [See page 9]. No terreneous globe is meant when the Word says, “O earth, earth, earth, hear the words of Jehovah.”

Owing to the general ignorance of mankind regarding the spiritual signification of the symbols, or similitudes mentioned in the Word, many have thought that by the last judgment and the consummation of the age there described, the end of the natural world is to be understood. But nothing could be farther from the truth than this thought. It was the last judgment of the most ancient Church when their posterity perished by the flood described in Genesis, a last judgment was executed by the LORD at his advent into the world, a last judgment was executed by Him in the spiritual world at His second advent in 1757; it is the last judgment with every man individually when he dies, but it is altogether a vain thing to imagine that either of these visitations could involve the destruction of the world. All such fallacies have come to an end and will continue to do so for the simple reason that the declarations of the Word are understood in a grossly literal sense, the sense of the “letter which killeth,” overlooking that of the “spirit, which giveth life.”

The end of the world prophets existed as long ago as the tenth century. According to Michelet's French History, it was the universal belief of the middle age that the thousandth year from the nativity of Christ would be the end of the world, and accordingly an immense amount of property was willed by the owners to the Church, who expected to stand well at the judgment by reason of their liberality. Many deeds of the Church lands begin with the words, “In the approaching end of the world, I Count, or Baron, give to such and such a Church, or monastery, such and such property, for the benefit of my soul.”

Joseph Mede, the greatest authority on this subject, twice fixed the end of the world during the last century, and once during his lifetime.

Dr. Woolf, a missionary to Bochara for the conversion of the Jews, calculated from the prophecies that the world would come to an end in 1848. When some one asked him during the following year how he came to make so great a mistake, the frank answer was returned, “Because I was a great ass.” If other end of the world prophets had been equally candid, the victims of this deplorable delusion would have been much less numerous than they are at present.

Lord Napier, the discoverer of Algebra, made out that the end of the world would take place in 1810,

In the "Commentary on the New Testament" published under the direction of Mr. Wesley, the period fixed was 1830. Bengel, a mystical writer, calculated that the millennium would begin in 1826, and last 2000 years.

Father Miller, as he was called, computed that the burning of the world would take place in the fall of 1843, or sometime during the following year, and eventually it was given out as a sure thing that the end would come on the 22nd of October, 1844, when the LORD would appear visibly in the clouds of heaven. Thousands were rendered almost insane with excitement. Business was paralyzed and stores were closed in New York by the score. One stove dealer closed his place of business declaring that no more stoves would ever be wanted in this world. A shoemaker tried to wind up business by giving away his stock. A dealer in fruit, cakes, and confectionery disposed of his stock in a similar manner to the great delight of the children, who warmly welcomed the propagation of this new faith among the confectioners and fruit dealers. The day appointed for the final collapse of the creation came round at last, but as might have been expected, nothing collapsed except the prophecy. One might reasonably have supposed that this exploded delusion would have ended at this point, but even now, some thirty years later than the above date, Mr. Miller's followers are still as sanguine as ever that a literal destruction of the earth is impending.

Dr. Cummings has been at immense labor to prove that the end of the world would take place in 1867.

Thousands in Canada will remember the excitement caused by a Mr. Baxter, several years ago, while delivering lectures to prove the impending destruction of our planet at an early day. That day has long since passed and gone, and the face of nature is still as fair as ever. I certainly know that if not admitted into their pulpits, Mr. Baxter was invited by respectable clergymen to address their Sunday School classes and succeeded in badly frightening some of the children by his fire and brimstone end of the world harangues.

These lamentable fallacies have been adduced for the sole purpose of showing the dangerous error-man may shun by a proper use of the inestimable disclosures given by the LORD through Swedenborg, as an unerring guide to the right understanding of the Word. It will not be unprofitable in this connection to consider the past existence of the human race as well as its future. Rollin, the historian, traces up the history of some of the ancient peoples to within a hundred years of the date usually assigned to the flood, and is much perplexed to account for the existence of powerful nations possessing well organized armies, embracing hundreds of thousands of fighting men at that early period. The historian, with many others, both before and since his time, never thought that by the flood described in Genesis we are to understand, not a flood of water, but a flood of iniquity or wickedness, and this is the true meaning of the term wherever it occurs in Scripture. Such a flood took place when the Messiah was cut off, at the end of the Jewish dispensation, see Dan. ix., 26, and such floods are frequently referred to throughout the Psalms and Prophets, as well as in the New Testament, and always with this signification. Let a man take his Concordance and examine the passages, and he will be astonished at their number. The Divine idea is expressed in this manner from the correspondence existing between a flood of water, which destroys natural life, and a flood of iniquity, or wickedness, which destroys spiritual life. Furthermore, the narrative of the flood, being written in the most ancient style of composition, which consisted in the use of symbols, similitudes, and allegories, in the description of everything relating to wisdom, is to be understood in a different manner from that literal or true history which begins at the end of the eleventh chapter of Genesis. "The hieroglyphics inscribed on the temples, columns, and buildings of the Assyrians and Egyptians, and the wisdom according to which the early Greeks framed their mythologies and fables, were all derived from the fragmentary knowledges regarding the correspondence between spiritual and natural things, derived from the ancients."

Sir William Jones computes the first book of Vedas to be 2800 years older than the birth of Christ, which according to the Hebrew calculation is 800 years before the time of Abraham. In that remote age the Hindoos possessed written books of religion. We copy the following from the *Nation*,

"In the issue of *Nature* for October 2nd, Russet Wallace indulges in some speculations on the probable antiquity of the human species which may well startle even those who have long since come to the conclusion that 6,000 years carry us but a small way back to the original homo. In fact, in Mr. Wallace's reckoning, a thousand years are but as a day. He begins by complaining of the timidity of scientific men when treating of this subject and points out the fallacy of always preferring the lowest estimate in order to be on the safe side. He declares that all the evidence tends to show that the safe side is probably with the large figures. He reviews the various attempts to determine the antiquity of the human remains or works of art, and finds the bronze age in Europe to have been pretty accurately fixed at 3,000 to 4,000 years ago, the stone age of the Swiss dwellings, at 5,000 to 7,000 years, and an indefinite anterior period. The burnt brick found 60 feet deep in the Nile alluvium, indicates an antiquity of 20,000 years; another fragment at 72 feet gives 30,000 years. A human skeleton found at a depth of 16 feet below four buried forests superposed upon each other, has been calculated by Dr. Dowler to have an antiquity of 50,000 years. But all these estimates pale before those which Kent's Cavern at Torquay, legitimates. Here the drip of the stalagmite is the chief factor of our computation, giving us an upper floor which "divides the relics of the last two or three thousand years from a deposit full of the bones of extinct mammalia, many of which like the reindeer, mammoth and glutton, indicate an arctic climate, names cut in this stalagmite more than 200 years ago are still legible; in other words, where the stalagmite is 12 feet thick, and the drip still copious, not more than a hundredth of a foot has been deposited in two centuries—a rate of 5 feet in 100,000 years. Below this, however, we have a thick, much older and more crystalline (*i. e.* more slowly formed) stalagmite beneath which again, "in a solid breccia, very different from the cave earth, undoubted works of art have been found." Mr. Wallace assumes only 100,000 years for the upper floor, and 250,000 for the lower, and adds 150,000 for the intermediate cave earth, by which he arrives at the sum of half a million as representing the years that have probably elapsed since flints of human workmanship were buried in the lowest depths of Kent's cavern."

Mr. Frank Calvert, of the Dardanelles, whose archaeological and geological attainments stand high, has informed the *Levant Herald* that from the face of a cliff composed of strata belonging to the Miocene period of the Tertiary age he has extracted the fragment of a bone of either a *dinotherium* or *Mastodon*, engraved with the figure of a horned quadruped; from which he concludes that the remarkable fact is thus established beyond a question that the antiquity of man is no longer to be reckoned by thousands, but by millions of years.

Regarding the Post Pliocene skull lately discovered, it is admitted by Prof. Huxley to be a "fair human skull, which might have belonged to a philosopher, or contained the thoughtless brains of a savage." These flinty facts bear rather hard on the evolution theory of Darwin, and certainly go to show that if the human race have been evolved from apes and monkeys, according to his account, our ancestors must have lived in such "good old times" that the relationship must be very distant indeed.

ORIGIN OF MATTER.—"That substances or matters like those on the earth were produced by the sun from its atmospheres, is affirmed by all who think that there are perpetual intermediations from the first to the last: and that nothing can exist but from a prior self, and at length from the First: and the First is the sun of the spiritual world, and the first of that sun is God-man, or the LORD. Now as the atmospheres are the prior things by which that sun presents itself in ultimates, and as these prior things continually decrease in activity and expansion; to ultimates, it follows that when their activity and expansion cease in ultimates, they become substances and matters like those on the earth; which retain from the atmospheres, whence they originated, an effort and endeavor to produce uses. Those who do not conceive the creation of the universe and all things therein, by continual mediations from the First, cannot but build unconnected hypothesis disjointed from their causes, which, when examined by a mind that looks interiorly into things, appear not like houses but like heaps of rubbish.

The origin of earths, treated of above, may show, that in the substances

and matters of which they consist, there is nothing of the Divine in itself, but that they are deprived of all that is Divine itself; being as was then said, the ends and terminations of the atmospheres, whose heat has ended in cold, their light in darkness, and their activity in inertness; but still they have brought with them, by continuation from the substance of the spiritual sun, that which was there from the Divine, which was a sphere surrounding God-man or the LORD; from this sphere by continuation from the sun, proceeded by means of the atmospheres, the substance and matters of which the earths consist.

Every one who thinks from clear reason, sees that the universe is not created from *nothing*, because he sees that it is impossible for anything to be made out of nothing, for nothing is nothing, and to make anything out of nothing is a contradiction, and a contradiction is contrary to the light of truth which is from the Divine wisdom; and whatever is not from the Divine wisdom is not from the Divine Omnipotence." In another place he writes, "Since the subsistence of all things of nature is from the sun, it follows that the existence of all things is so too."

The above were singular statements to put forth during Swedenborg's day, when it was almost universally accepted as a truth that the world was created out of nothing, in the space of six days, about 6000 years ago. But since that time science has abundantly demonstrated the truth of what he taught, and this so clearly, that at this day no intelligent man can be found who will deny that this planet derived its origin from the sun, and this at a period of time so inconceivably remote, that the capacity of the human mind fails to grasp the immensity of its duration.

"The globe in the first state in which the imagination can venture to consider it" says Sir H. Davy, "appears to have been a fluid mass, with an immense atmosphere, revolving in space around the sun. By its cooling, a portion of its atmosphere was probably condensed into water, which occupied a portion of its surface. In this state, no forms of life such as now belong to our system, could have inhabited it. The crystalline rocks, or as they are called by geologists, the primary rocks, (granite) which contain no vestiges of a former order of things, were the result of the first consolidation on its surface. Upon the further cooling, the water which more or less had covered it, contracted; depositions took place; shell fish and coral insects were created, and began their labors. *Islands appeared in the midst of the ocean, raised from the deep by the productive energies of millions of Zoophites.* These islands became covered with vegetables fitted to bear a high temperature, such as palms, and various species of plants, similar to those which now exist in the hottest parts of the world. The submarine rocks of these new formations of land became covered with aquatic vegetables, on which various species of shell-fish, and common fishes found their nourishment. As the temperature of the globe became lower, species of the oviparous reptiles appear to have been created to inhabit it, and the turtle, crocodiles, and various gigantic animals of the Saurian (lizard) kinds seem to have haunted the bays and waters of the primitive lands. But in this state of things, there appears to have been no order of events similar to the present. Immense volcanic explosions seem to have taken place, accompanied by elevations and depressions of the surface of the globe, producing mountains, and causing new and extensive depositions from the primitive ocean. The remains of living beings, plants, fishes, birds and oviparous reptiles are found in the strata of rocks which are the monuments and evidences of these changes. When these revolutions became less frequent, and the globe became still more cooled, and inequalities of temperature were established by means of the mountain chains, more perfect animals became its inhabitants, such as the Mammoth, Megalonyx, Megatherium, and gigantic hyena, many of which have become extinct. *Five successive races of plants, and four successive races of animals, appear to have been created, and swept away by the physical revolutions of the globe, before the system of things became so permanent as to fit the world for MAN.*" The various strata of the earth appear to have been deposited by the action of water, and in reference to this we quote from Prof. Agassiz, "that if the sediment from all the rivers in the world were spread equally over the ocean, it would require a thousand years to raise its bottom a single foot; or about 4,000,000 of years to form a mass equal to the fossiliferous rocks; and if instead of merely the present extent of the sea we

include the whole surface of the globe in such estimate, the time required must be extended to 15,000,000 of years. The fossiliferous strata have been estimated to be eight miles in thickness." From the above it would seem that fifteen million years have been required to produce the strata that have been formed since the dry land appeared, and the herb first grew upon the earth.

No man can estimate the time required to cool the crust of the earth sufficiently to admit of the growth of vegetation, and even now, from recent experiments made at Crenzot in France, it has been demonstrated that the internal heat of the earth 50 miles from the surface, is 4,600° an intensity more than sufficient to melt platinum and fuse the hardest rocks. The falls of Niagara were at one time precipitated into an ocean existing near the foot of Queenstown heights, and must have taken at least 30,000 years to cut their way through seven miles of rock back to their present position, and the retrograde movement is still going on, slowly but surely, every day. That the ocean existed at one time in the vicinity of Niagara is evident from many proofs, from this among others, that the skeleton of a whale was dug up in that neighborhood but a few years ago.

A volcano now extinct, near Mount D'Orr in the interior of France, emitted a flow of lava at a comparatively recent period, which filled up the channel of a river in its course. The water rose, passing over the impediment in its course, and has up to this time cut a channel 50 feet deep through the lava bed. From the remains of an old Roman bridge known to have been constructed about 2000 years ago, it appears that the erosion of the water into the lava has been considerably less than six inches during that period, which would indicate that it has required over 200,000 years to cut the channel to its present depth of 50 feet!

Myriads of ages have elapsed while the rushing waters have been cutting out those tremendous ravines in the hard rock, known as the Canyons of Mexico, Texas, Colorado and the Rocky Mountains. The great Canyon of the Colorado river is 298 miles long, and the sides rise perpendicularly above the water to a height of 5000 or 6000 feet.

As justly observed by the learned and judicious Dr. Bayley of London, "Geology speaks as loudly as any other science of creation, by the power of the Infinite Creator. Geology leads us from the living, blooming surface of the world on which we stand, through miles upon miles of strata, formed time after time, through incalculable ages, but always conducts us to a beginning. Though we pass through the tertiary strata, and we notice through all the beds of pleistocene, pliocene and eocene, the indications of ever-varying life, through the seventeen hundred feet deep of sands, clays, crags, the results of ages of creative energy, yet during the secondary formations, they were not. Through the cretaceous walden, and oolitic deposits, again, crowded with the fossil remains of life, forming three or four thousand feet thick of strata, all of which were once swarming with living beings, yet there was a time, however remote, when they were not. And, pass we lower still, through the lower oolites, the lias and the triassic beds of the Mesozoic formations, or through the 80,000 feet of the magnesian limestone, the coal measures, and the Devonian and Silurian deposits, notwithstanding we are conducted to periods inconceivably remote, yet the mind sees as clearly as it discerns it of the daisy of to-day—all these began to be, and in their beginning, and through all their changes they are the results of the Almighty energies of that Adorable One "by whom all things have been made that are made."

ON CORRESPONDENCES.—"It has been given me to know from much experience that in the natural world, and in its three kingdoms, there is not the smallest thing which does not represent something in the spiritual world, or which has not something there to which it corresponds. Moreover, nothing is ever given in the created world, which has not correspondence with things existing in the spiritual world, and which does not live in its own manner, represent something in the LORD'S KINGDOM; thence is the existence and subsistence of all things. If man knew how these things are, he would never attribute all things to nature, as is usually done. I will, however, illustrate what is the nature of the correspondence between spiritual things and natural, by some examples.

The animals of the earth, in general, correspond to affections, the tame and

useful animals corresponding to good affections, and the fierce and useless kinds to evil affections. In particular, oxen and bullocks correspond to the affections of the natural mind; sheep and lambs to the affections of the spiritual mind; and birds or winged creatures, according to their species, correspond to the intellectual faculties and exercises of both minds. Hence it is that various animals, as oxen, bullocks, rams, sheep, she-goats, he-goats, and male and female lambs, also pigeons and doves, were employed in the Israelitish church, which was a representative one, for holy uses, it being of them that the sacrifices and burnt offerings consisted; for when so employed, they correspond to certain spiritual things and were understood in heaven according to their correspondences. Animals, also, according to their genera and species, actually are affections; the reason of which is because they live; and nothing can have life, except from affection, and according to it. Hence, likewise, it is that every animal possesses an innate knowledge according to the affection of its life. Man, too, as to his natural man, in like the animals, wherefore, also, it is usual to compare him to them in common discourse. Thus a man of mild disposition is called a sheep or a lamb; a man of rough or fierce temper is called a bear or a wolf; a crafty person is termed a fox or a serpent; and so in other instances. A garden in general corresponds to heaven as to intelligence and wisdom; wherefore heaven is called in the Word the garden of God, and paradise, and is also named by man the heavenly paradise. Trees, according to their species, correspond to perceptions and knowledges of good and truth, from which are procured intelligence and wisdom, and hence it is that, in the Word, trees are so often mentioned, and heaven, the church, and man are compared to them, as to the vine, the olive tree, the cedar, and others; and good works are compared to fruits. The various kinds of food, also, which are obtained from them, especially those from grain, correspond to affections of good and truth, because these sustain man's spiritual life, as earthly food sustains his natural life. Hence bread, in general, corresponds to the affection of all good, because it supports life better than other aliments, and because by bread is meant all food whatever. On account of this correspondence, also, the Lord calls Himself the bread of life; and for the same reason loaves were placed upon the table in the tabernacle and called the shew-bread; and hence, likewise, all the divine worship performed by sacrifices and burnt offerings were called bread. On account, also, of this correspondence, the most holy solemnity of worship in the Christian church is the holy supper, the elements used in which are bread and wine."

We will see a surpassing beauty shining through the literal sense of the Word when once we admit the grand principle according to which the whole of it is written, namely, that in it there is not employed a single name, word symbol or similitude, but what is made use of to denote and signify corresponding interior or spiritual things. Hence good and truth, or love and wisdom are meant and signified when corresponding good and useful things are mentioned, such as the sun and moon, fire, heat, and light, rain and dew, earth and seas, wells and springs of water, flesh and blood, bread, corn, wine, oil, milk, honey, gold, silver, brass, iron, rocks, stones, precious stones, pearls of great price, garments, treasure hid in a field, &c.

In like manner, good men are called angels, sheep, lambs, and in general all useful animals and birds, trees of righteousness, fruitful vines, cedars, oaks, palm, olive, bay and fir trees, good seed, fruitful fields, watered gardens, &c.

For the same reason wicked men are called devils, serpents, scorpions, adders, a generation of vipers, dragons, leopards, roaring lions, swine, corn-rats, owls, ravens, thorns, thistles, brambles, tares, overflowing floods, and other hurtful and malignant things in nature.

It is written of the Word Incarnate, that "without a parable spake He not unto them," and as all that He spake proceeded from the inmost Divine, or the Father in Him, it is manifest that the whole of the Word, inasmuch as it proceeds from Him alone, must be spiritually understood, according to His own saying, "the words I speak unto you they are spirit and they are life."

It is from this its divine origin that the Word is as it were alive, each expression involving infinite and ineffable things, and this in such inexpressible measure and variety that it may be compared to an inexhaustible gold mine which is continually yielding up its treasures to reward the explorer. To the heavenly mind it is heavenly food, for it is by every word that proceedeth out of the mouth of the Lord that man doth live." Deut. viii. 3. Matt. iv. 4. Such is nourishment of spiritual life.

THE DAYS OF CREATION SIGNIFY SIX STATES OF MAN'S REGENERATION —
 "The six days, or times, which are so many successive states of the *regeneration* of man, are in general as follows:—

The **FIRST** state is that which precedes, including both the state of infancy, and the state immediately preceding regeneration. This is called vacuity, emptiness and darkness; and the first motion, which is the mercy of the **LORD**, is the Spirit of GOD moving upon the faces of the waters.

The **SECOND** state is when a division takes place between these things which are of the **LORD** and such as are proper to man. The things which are of the **LORD** are called in the Word remains, and are here principally the knowledges of faith, which man has learned from infancy, and which are stored up, and are not manifested till he comes into this state. This state at the present day seldom exists without temptation, misfortune or sorrow, by which the things appertaining to the body and to the world, that is, such as form the *progrium* or *selfhood* of man, are brought into a state of quiescence, and as it were of death. Thus the things which belong to the external man, are separated from those which belong to the internal. In the internal man are the remains, stored up by the **LORD** till this time, and for this purpose.

The **THIRD** state is that of repentance, in which the regenerating subject, from the internal man, begins to discourse piously and devoutly, and to do good actions, like works of charity, but which nevertheless are inanimate, because they are supposed to originate in himself. These good actions are called the tender grass and also the herb yielding seed, and afterwards the tree bearing fruit.

The **FOURTH** state is when man becomes affected with love, and illumined by faith. He indeed previously discoursed piously, and produced the fruits of good actions; but he did so in consequence of the temptation and straitness under which he labored, and not from a principle of faith and charity; wherefore faith and charity are now enkindled in his internal man, and are called two lights (or luminaries).

The **FIFTH** state is when man discourses from a principle of faith, and thereby confirms himself in truth and goodness: the things then produced by him are animated, and are called the fishes of the sea and the birds of the air.

The **SIXTH** state is when from a principle of faith and thence of love he speaks what is true, and does what is good; the things which he then produces are called the living soul and the beast. And because he then begins to act from a principle of love as well as of faith, he becomes a spiritual man, and is called an image. His spiritual life is delighted and sustained by such things as relate to knowledges respecting faith, and to works of charity, which are called his meat; and his natural life is delighted by such things as belong to the body and the senses; from whence a combat or struggle arises until love gains the dominion and he becomes a celestial man.

They who are regenerating do not all arrive at this state. The greatest part at this day, attain to the first state; some only to the second; others to the third, fourth, and fifth; few to the sixth; and scarcely any to the seventh."

The foregoing is a part of Swedenborg's explication of the first chapter of Genesis, and the reader is referred to the 1st. Vol. of his *Arcana* for the Scripture proofs and detailed explanation, as they are necessarily omitted in this place for want of space. Many modern theologians are afraid to enter on an interpretation of this chapter on account of its alleged conflict with the known facts of science, but the theology that could be endangered by such an investigation is worthy of no man's acceptance. Others, again, have erred as far on the other side. Professors Jowett, Baden Powell, the Rev. Messrs. Temple, Goodwin, Wilson, and other eminent clergymen of the church of England, who have figured as the authors of the "The Essays and Reviews," together with Bishop Colenso, all men of great scientific attainments, have made many rash comments and wild averments on this subject. Acting on the rule that you must "interpret the Bible as you would any other book," one of these gentlemen writes as follows: "We have examined it and find it is not correct in its science. Its astronomy is Jewish, not philosophical, and as to its geology that is certainly not correct. Its chronology is faulty, the earth is much older than the Bible makes it, and the account of the universal deluge cannot be made to harmonize with the facts of ancient history. Nations have existed in continuity from periods long before the time fixed

as that of the deluge. Some of the pyramids were undoubtedly in existence long before the time of the deluge, and although geology gives evidences of hundreds of local floods, and of the gradual change of the ocean's bed, again and again, yet it lends no support to the account of a contemporaneous covering of the whole earth at the same time, with many miles deep of water. Besides many things in the Bible seem puerile, trivial, unworthy of God. I don't see why the Jewish history is more a Divine history than that of the great nations of the earth, or in fact than any other."

Most assuredly this is giving us a stone when we are asking for bread. If a man desires enlightenment regarding the formation of the primary or stratified rocks, the coal measures, minerals, fossils, plants, or to solve the complex problems of astronomy regarding the nature, movements and distances of the bodies belonging to the solar or stellar systems, it is an absolute certainty that he would never think of consulting Genesis or any other part of the inspired volume. It may be manifest to every man that whatever is revealed by the spirit of God must be spiritually understood, and further, it is equally certain, that those things for the discovery of which man has faculties specially provided, are not fit objects of a Divine revelation, consequently if follows, that by the description in Genesis we are by no means to understand the creation of the terraqueous globe. The creation described in Genesis is one incomparably more wonderful than the creation of a world, being nothing less than the narration, in a heavenly style, by means of natural symbols and similitudes, of the various stages of that marvellous and mysterious Divine work whereby man is made a new creature.

In the Divine idea, to *create*, to *form*, to *make*, signifies to regenerate, and of this creation we find frequent mention in the Word, but very little of any other. Thus in the Psalms, "Thou sendest forth thy spirit they are *created*," civ. 30. "The people which shall be *created* shall praise the LORD," cii. 18. "*create* in me a clean heart, O God," li. 10 and in Isaiah. "This people have I *formed* for myself that they may shew forth my praise" xliii. 21. I have put my words in thy mouth,—that I may plant the heavens, and lay the foundation of the earth and say unto Zion, Thou art my people" li. 16. "Every one that is called by my name, I have *created* him; I have *formed* him; yea, I have *made* him" xliii. 7. To be called by the LORD's name, is to have the LORD's nature implanted in the heart.

Unregenerate man is described in Jeremiah in nearly the same terms as in Genesis, "I beheld the earth, and lo, it was without form [empty] and void, and the heavens, and they had no light," iv. 23 and in David, "They walk on in darkness, all the foundations of the earth are out of course" lxxv. 5. "The earth and all the inhabitants thereof are dissolved," lxxxv. 3 and in Isaiah, "The earth is clean dissolved, the earth is moved exceedingly," xiv. 19. Read the whole chapter. Again in Haggai, "I will shake the heavens and the earth, and the sea, and the dry land, and I will shake all nations, and the Desire of all nations shall come," ii. 6, 7. The ruin of a soul or of a church is here clearly symbolized by the ruin of a world, and darkness exists "on the face of the deep" when the mind of man is in this state. The people who walk in darkness see a great light when they receive and obey the truth as purity.

The faces of the waters over which the Spirit of God moves, consists of all the knowledges of good and truth implanted in the mind from infancy to manhood, embracing what he may have learnt from the Word or from teachers, states of love towards parents or friends, or of innocence from infancy, mercy to the poor, love towards neighbors, and every other state of good and truth gathered up in the memory or internal man. It is only by gently brooding over moving and acting on, in, and through these remains of good and truth that the LORD finally regenerates man.

Light comes into existence on the *first* day, Light signifies knowledge, day signifies state. The soul has a succession of states corresponding to the days and nights in nature. The Divine Mercy always insinuates mildly, always leads man gently, never forces, but inclines man to freedom. It says, "Let there be light," and when in the exercise of that imparted freedom the trusting child of GOD turns for illumination and instruction to his Heavenly Father, it can be truly said "And there was light."

The work of the *second* day or state has reference to *water*. Water is the symbol of truth, "Except a man be born of *water* and of the Spirit he cannot

see the kingdom of God," John iii 5, signifies to be born of truth and to live a life according to it. "Ho, every one that thirsteth, come ye to the waters," Isa. lv. 1 is a call addressed to all thirsting for truth, and not natural water. The internal man is the firmament. The knowledges in the internal man are the waters above the firmament and the scientifics of the natural man are the waters below the firmament. The *second* stage is to distinguish between the truth relating to GOD and heavenly things, and duty towards man and a good life on earth.

The work of the *third* day is to produce the dry ground, or earth and grass, herbs, fruit trees, &c., denoting the soul's progression in the fruits of goodness, charity, and loving kindness, and doing good from delight in truth. The seed falls into good ground and brings forth fruit. "The good ground is an honest and good heart," Luke viii. 15. This Divine work is carried on gradually according to a truly Divine order, not by fits and starts, or by getting perfect in a twinkling, as some rashly affirm. The Canaanites were driven out from before Israel little by little, to symbolize the manner in which evils are expelled from the heart during regeneration. In spiritual as in natural things, "it is first the blade then the ear, and afterwards the good corn in the ear." Mark iv 28. Good men who arrive at this state are styled in Isaiah "Trees of righteousness, the planting of Jehovah," lxi. 3.

This sublime narrative can never be understood in a literal sense, for the reason that day and night, water, light, grass, fruit trees, &c., could not as yet exist owing to the absence of the sun. The terrible desolation over the face of nature would have rivalled that of an arctic winter with its universal reign of ice.

By the creation of the sun moon and stars on the *fourth* day is signified a state of progression in the knowledge and experience of the love of GOD in the heart, and faith in the intellect, together with abounding knowledges of truth. The man feels that the LORD is the Sun of the eternal world, a "Sun and shield," a "Sun of Righteousness," the emanation of whose heat is Divine love and the effulgence of whose light is Divine truth. In this state he arises and shines, for his light has come, and the glory of the LORD has risen upon him. His aspirations are Heavenward. He feels the supreme blessedness of doing good, and knowing truth. Faith shines like a moon in the lower states of the soul represented by evening, when love declines in the varied states of spiritual life. Winter symbolizes a state of the soul when love is absent. Our LORD says "Pray ye that your flight be not in the winter, for in those days shall be affliction," Mark xii 8. 9. *Flight* signifies the last time or the time of one's death, *winter* signifies a state destitute of love. *days of affliction* signifies man's miserable state in the other life.

On the *fifth* day the water brings forth every living thing that moveth, and every winged bird after his kind. Water is the emblem of truth and brings forth abundantly when the soul is full of love. The scientific activities of a heavenly mind rejoicing in the truth are the fish of the holy waters [Ezek xlvii 10]. A mind in rational order is like a clear, calm, and placid lake or river swarming with fish. Birds represent things rational, spiritual and intellectual. He who draws wisdom from GOD is like a bird soaring aloft, enjoying a clear and extensive view. "They mount up with wings as eagles," &c., Isaiah ix 31. Birds of night, as bats and owls, represent those who have no inclination for truth.

Although in this first chapter, birds and every living thing that moveth derive their origin from the water on the *fifth* day in the second chapter [ver. 19.] they are described as being made out of the ground by JEHOVAH GOD on the *seventh* day, denoting man's state when all inward conflict with sin and self has ceased, for then the purest affections of love come direct from the heart, celestial peace reigns and man is in Paradise. Then indeed he is blessed by JEHOVAH GOD, for this double name, with LORD, or JEHOVAH first, signifies the Divine Love and Wisdom combined, the term JEHOVAH having direct reference to the Divine Love while the term GOD mentioned throughout the first chapter, signifies the Divine Wisdom.

The formation of cattle, creeping things, and beasts of the earth on the *sixth* day, represents a further ripening of the best affections of the heart, such as loving kindness, charity, obedience and innocence. Regarding the symbolic meaning of animals, almost every page of the word testifies regarding it.

On this day [the sixth], man is made in the image and likeness of **GOD**. The former steps or stages were merely preparatory to this great work. Man is not, as the simple might say, merely a form in human shape, for such are frequently worse than wild beasts. The Blessed Redeemer called Herod a fox, and He certainly knew the proper name to express his character. The Divine idea of a man is fully defined in Jer. v. 1 and there we see it is one who "executeth judgment and seeketh the truth," or one who from an affection and love for the truth, lives a life according to it. The absence of such from the earth is fitly described in the preceding chapter, ver. 25 "Behold and lo, there was no man, and all the birds of the heavens were led."

As God regenerates man through the ministration of angels, He says, "Let us make man," but as this is effected solely by His own proper power, it is immediately added in the next verse. "So God created man in his own image," and in chap. ii. 7. "So **JEHOVAH GOD** formed man out of the dust of the ground." The Divine aim with His rational creatures is evermore to bring them up to "the measure of a man that is of an angel," Rev. xxi. 17. when this is accomplished, He can view His work and pronounce it "very good," and enter on the rest signified by the seventh day, for it is the **LORD** alone who fights for man during temptation, and sustains him during the conflict with the powers of darkness.

ON THE DIVINE PROVIDENCE AND TRUST IN THE LORD. "They who put their trust in the **LORD** continually receive good from him, for what so ever befalls them whither it appears as prosperous or unprosperous, is still good, for as a medium it conduces to their eternal felicity; but they who put their trust in themselves, continually induce evil upon themselves, for whatsoever befalls them, although it appears as prosperous and happy is nevertheless evil, and hence as a medium conduces to their eternal unhappiness. If you are willing to be led of the Divine Providence use prudence, as a servant and minister who faithfully dispenses the goods of his master; this prudence is the pound which was given to the servants for trading, of which they should give an account, Matt. xxv. 14-25. This is the prudence with which the Divine Providence acts as one."

A LIFE OF CHARITY IS A LIFE OF USES, FULL OF DELIGHTS.—"In reference to **USE** it may be observed, that they who are in charity, that is, in love towards the neighbor, which imparts a living delight to their pleasure, look for the fruition of no pleasure, except in the performance of uses; for charity is a nothing unless it manifests itself in the works of Charity, since it consists in exercise or use. He who loves his neighbor as himself never perceives the delight of charity except in its exercise, wherefore a life of charity is a life of uses. Such is the life of the universal heaven; for the **LORD's** kingdom, being a kingdom of mutual love, is a kingdom of uses; hence every pleasure derived from charity receives its delight from use, and the more exalted the use, so much the greater is the delight; and hence the angels receive happiness from the **LORD** according to the essence and quality of the use they perform. So also it is with every pleasure, for the more distinguished its use, so much the greater its delight."

ON PREDESTINATION.—"Sound reason dictates that all are predestined to heaven and no one to hell.—The end of creation is a heaven from the human race.—Every man was created that he might come into heaven.—The Divine Love cannot do otherwise than will this, and the Divine Wisdom cannot do otherwise than provide for it. Hence it is from the Divine Providence that every man can be saved, and that they are saved who acknowledge God and live well. Man himself is in fault if he is not saved. Any other predestination than to heaven is contrary to the Divine Love which is infinite;—also contrary to the Divine Wisdom which is infinite.—Through Divine truths and Divine goods as means, the Divine Providence operates its end, which is the salvation of man; for he who wills the end, wills also the means.—The operation of the Divine Providence for saving man commences from his birth, and lasts until the end of his life, and afterwards to eternity. That this may be understood, it is to be known, that the **LORD** sees what man is, and foresees what he wills to be, thus what he is to be; and the *freedom of his will cannot be taken away*, that he may be man and thence immortal, as has been before shown in many places; wherefore the **LORD** foresees his state after death, and provides for it from his birth even to the end of his life; with the evil he provides, by permitting and continually withdrawing from evils; but with the good he provides, by leading to good; thus the Divine Providence is

continually in the operation of saving man, but there cannot be more saved than are *willing* to be saved, and they are willing to be saved who acknowledge God and are led by Him, and they are not willing who do not acknowledge God, and lead themselves. It is by influence from hell that man does evil, and by influence from the LORD that he does good. But as man believes that whatever he does, he does from himself, the consequence is, that the evil which he does adheres to him as his own. It hence follows that the cause of his own evil lies with man, and not at all with the LORD. Evil as existing with man, is hell, as existing with him, for whether you say evil or hell, it amounts to the same thing. Now since the cause of his own evil lies with man himself, it follows that it is he who casts himself into hell, and not the LORD, and so far is the LORD from leading man into hell that he delivers from hell, so far as the man does not will and love to abide in his own evil."

In reference to creeds and doctrines too well known as being at open war with the above statements, we would say that it is a healthy indication of the signs of the times to find the *New York Independent*, in an article on "Immoral Theology," using the following language, "To teach men that God is a being who has a perfect right to bring into the world a creature with faculties impaired, with no power to resist temptation, utterly unable to do right, powerless even to repent of the wrong which he is fated to do, and then send to everlasting misery this helpless creature for the sin he could not help committing—To teach such ~~as this~~ as this about God, is to inflict upon religion a terrible injury and to subvert the very foundation of morality. To say that God may justly punish a man for the sins of his ancestors, that God does blame us for what happened long before we were born, is to blaspheme God, if there be any such thing as blasphemy. To say that any such doctrine is clearly taught in the Bible, is to say that the Bible clearly teaches a monstrous lie. If there is one thing which is absolutely certain to every human being, it is that he cannot be held responsible for acts committed thousands of years ago, and that he cannot be blamed for not doing that which he is utterly without power to do. It is idle to say that it is nothing but a philosophical refinement, that the men who come out of our theological seminaries with these notions in their heads never make any use of them in the pulpit. They do make use of them. They are scattering this atrocious stuff all over the land. They are making infidels faster than they are converting sinners. The infidelity of this generation is due more to this than any other cause. We sometimes ordain men as foreign missionaries who profess to believe this medieval theology. Is it worth while to send to the heathen a preacher whose God is more unjust, if possible, than the gods of the heathen?"

CONCERNING THE HEATHEN AND OTHER NATIONS OUT OF THE CHURCH.—"It is a common opinion, that they who are born out of the Church, and who are called Pagans and Gentiles, cannot be saved by reason that they have not the Word and thus are ignorant of the Lord, without whom there is no salvation. But still that these also are saved, may be known from this alone, that the mercy of the LORD is universal, that is, extends to every individual man, that they are equally born men, as those who are within the church, who are comparatively few, and that it is no fault of theirs that they are ignorant of the LORD. With respect to Christians and Gentiles in another life, the case is this; Christians, who have acknowledged the truths of faith, and at the same time have led a life of good are accepted before Gentiles, but such Christians at this day are few in number; whereas Gentiles who have lived in obedience and mutual charity, are accepted before Christians who have not led a good life. When they are instructed, they behave themselves modestly, intelligently, and wisely, and easily receive and imbibe, for they have formed to themselves no principles contrary to the truths of faith, as is the case with many Christians who have led a life of evil. All persons throughout the universe are, of the mercy of the LORD, accepted and saved, who have lived in good, good itself being that which receives truth, and the good of life being the very ground of the seed, that is of truth; evil of life never receives it; although they who are in evil should be instructed a thousand ways,—still the truths of faith with them would enter no further than into the memory, and would not enter into the affection, which is of the heart; wherefore also the truths of their memory are dissipated, and become no truths in the other life."

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